SERVICE MANUAL

Castle®

2415–UW
Ultrasonic Cleaner

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Technology for Life

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Related Publications:

Owner & Operators Manual	350490
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DESCRIPTION OF SYMBOLS & NOTES IN MANUAL

The following symbols with related notes appear in this manual.

"Warning" notes alert the user to the possibility of personal injury.

"Caution" notes alert the user to the possibility of damage to the equipment.

"Notes" alert the user to pertinent facts and conditions.

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GENERAL INFORMATION

The Castle 2415–UW Ultrasonic Cleaner cleans surgical instruments and similar hospital hardware, using ultrasonic energy in a heated water-detergent solution. It uses a motorized lid and work platform to load and unload goods, fills the cleaning tank with hot water and detergent, controls the solution level, heats and maintains the solution temperature, agitates the solution with ultrasonic energy, times the wash cycle, and drains the tank when required.

To run a cycle, the operator first sets the timer. He then sets an instrument tray on the work tray platform. He presses a button to close the lid. The lid closes and lowers the tray into the liquid. The cycle activates automatically. When the cycle is complete, the work tray platform automatically lifts the tray out of the tank to where it can easily be removed to a rinsing station.

NOTE

While sonic cleaning effectively cleans and polishes instruments in a way unmatched by other methods, it does not replace the sterilization process. Instruments cleaned in the ultrasonic cleaner still need to be rinsed and sterilized before being put back into use.

This manual contains the necessary instructions for maintaining, testing, adjusting, and repairing the Castle 2415–UW Ultrasonic Cleaner. For optimum performance and unit life MDT recommends that only fully authorized personnel service your equipment. Refer to the warranty.

Unauthorized repairs will void the warranty.

WARNING

Only a fully authorized service person should attempt to service this product. The circuits present high level voltage. Improper testing or repair procedures could result in injury to the service person and damage to the product.

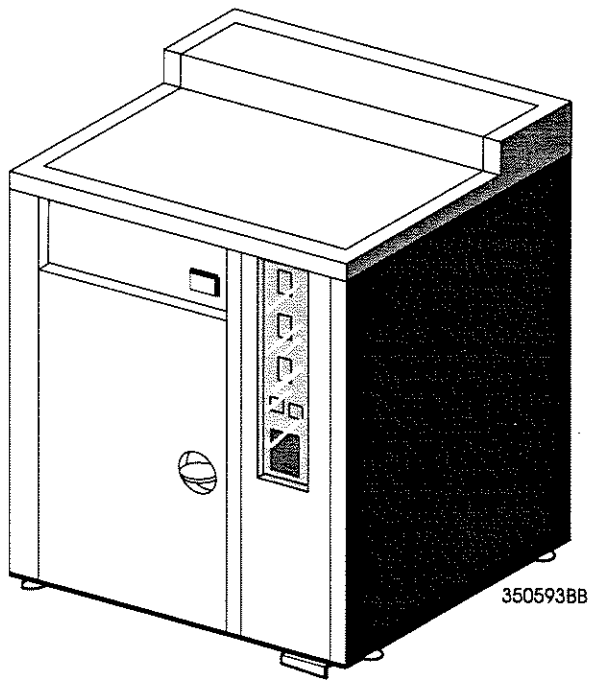


FIGURE 1–1. 2415—UW ULTRASONIC CLEANER

SERVICE FEATURES

- serviceable from the front
- front-access to toe switch, control panel fuses, and main power box
- detergent flow control is front-accessible
- liquid level probes, heater, thermostats are front-accessible
- removable, hinged front access door
- lift-off side panels
- interlock bypass
- plug–in relays in control box
- modular sonic generators
- hinged work tray platform for access to tank and strainer

SAFETY FEATURES

STOP button	Stops lid motion when actuated. Restart must be with the LID button, not the toe switch.
Motor Torque Limiter	Stops lid motion if something is caught in the lid.
Alarm	Sounds whenever the lid is moving.
Front Door Interlock	Power shuts off when front door is opened or removed. Fully extended, the front door switch bypasses this interlock for troubleshooting and repair with the door open.
Tank & lid	Insulated and sound dampened.

TECHNICAL DATA

ELECTRICAL

Domestic	120 VAC 60 Hz	23 amps 3-wire ground single phase
Wattage	2760 watts	
Output power, transducers	1000 watts	
Heater	1000 watts	

SERVICES

Hot Water	1/2" IPS 40-60 psi	(12.7 mm) (276-414 kPa)
	100-140°F	(38-60°C)
Drain	1¼" IPS	(31.8 mm)

WEIGHT

~475 lb.	(216 kg)

ULTRASONICS

piezoelectric transducers	24
Sonic generators	2 x 500 watt
Ultrasonic operating freq.	40 kHz

DIMENSIONS

Unit	30" L x 30" W x 40" H (762 x762 x 1016 mm)
Counter height	36" (914mm)
Tank	24" L x 18" W x 10 " D (610 x 457 x 254 mm)
Cham. volume	2.5 cu. ft. (0.07 cu. m.)
Tank capacity	12 gallons at 7" liquid depth (45.4 L at 178mm depth)
Max. tray size	21" L x 13" W x 4" D (533 x 330 x 102 mm)
Max. load	20 lb. (9.1 kg)
Heater	1000 watts. Maintains tank solution at 100-120° F (38-49° C)

ULTRASONICS SYSTEM

NOTE

Reference abbreviations such as 1G for Generator 1G are used in the Wiring Diagram and the Electrical Schematic (see Chapter 3, Service Data).

The ultrasonics system for the 2415–UW includes the sonic generators, the transducers, the isolation transformer, and the timer (see Figure 3-5, Wiring Diagram).

GENERATORS 1G, 2G

Produce the proper frequency and voltage required to drive the transducers.

TRANSDUCERS

Generate ultrasonic vibration using the piezoelectric effect.

TIMER 1TMR

Allows the user to enter the cycle time; counts down and displays the time remaining in the cycle.

TANK/LID COMPONENTS

LID

Closes and opens automatically when LID or the toe switch is pressed. When closing, it lowers the attached work tray platform into the tank. When opening, it raises the platform out of the tank.

LID GASKET

Provides a lid-to-tank seal when the lid is in the closed position.

WORK TRAY PLATFORM

Supports the work tray for ultrasonic processing. The forward half of the platform swings up out of the way for cleaning the tank.

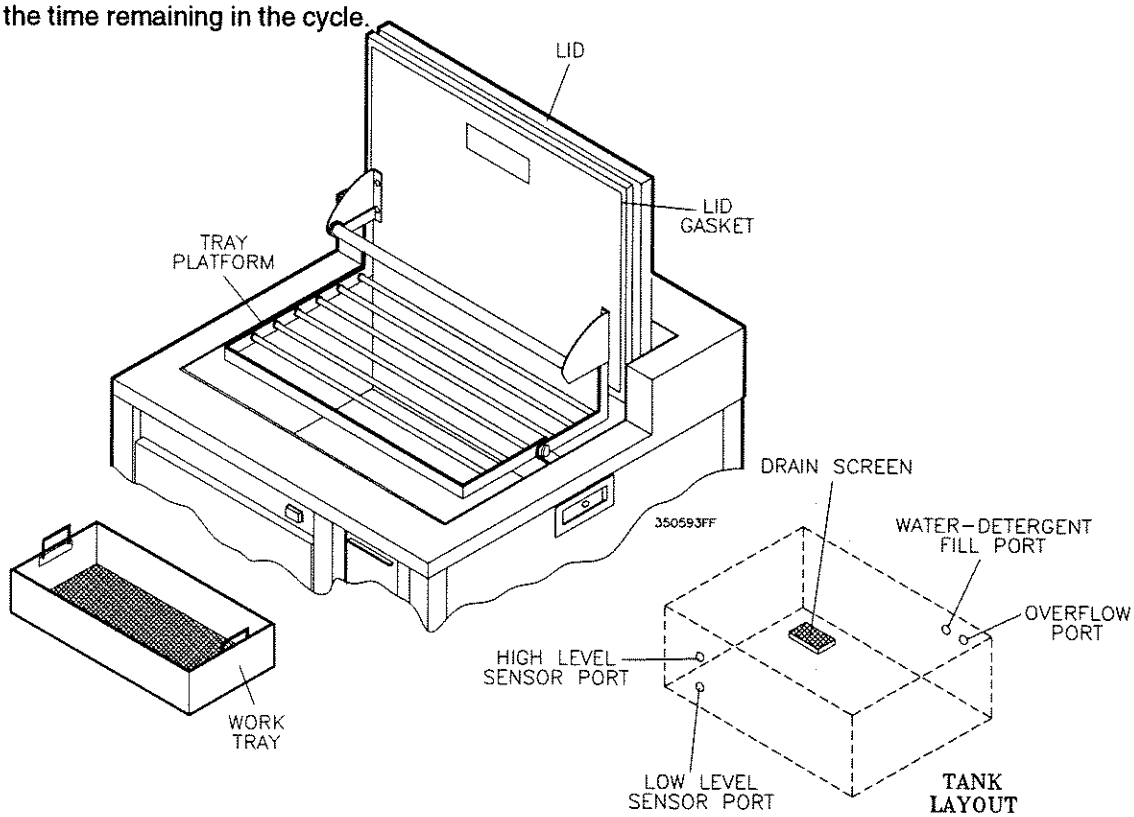


FIGURE 1–2. TANK/LID COMPONENTS

WORK TRAY

Holds the instruments to be processed.

MOTOR

Electric gearmotor rotates the cam plate that opens and closes the lid via a drive arm (see Figure 5-10). The cam plate also activates limit switches 1LS and 2LS.

TORQUE LIMITER

A safety device that disengages the motor from the cam plate if resistance increases to a set level. It prevents injury to the operator if something is caught between the lid and the tank.

Keep fingers away from a closing lid. Though equipped with a safety stop, it may bruise a trapped finger.

BRAKE

The brake engages and holds the motor shaft in position when it is in the POWER OFF condition (lid open or lid closed). It automatically releases when power is applied (lid in motion).

DRIVE ARM

Connects the cam plate on the motor to the lid to enable automatic opening and closing.

WATER-DETERGENT FILL PORT

Point where the water-detergent liquid solution enters the tank when FILL is pressed.

OVERFLOW PORT

Channels any excessive level of liquid out of the tank to the drain.

DRAIN SCREEN/DRAIN

Empties the washer tank after DRAIN is pressed. There is a pre-set time delay of 1.8 seconds in time-delay relay 1TDR before the drain opens. The drain screen prevents large soil particles or other foreign matter from entering the drain.

Pressing DRAIN again resets the time delay. This will prevent the drain from opening for another 1.8 seconds.

LOW LEVEL SENSOR PORT

Houses the low level liquid sensor 2LLC. The sensor activates the heaters that maintain the temperature of the tank solution.

HIGH LEVEL SENSOR PORT

Houses the high level liquid sensor 1LLC. The sensor activates the water supply shutoff when the level of the tank solution fill reaches 6¾–7 inches.

CONTROL COMPONENTS

NOTE ▶ *Names of components in CAPITAL LETTERS are their actual labels.*

CONTROL PANEL COVER

Magnetically latched plastic shield. Slides down for access to control panel.

POWER 1PB

Activates the controls. Yellow indicator lights when the button is engaged.

STOP 2PB

Deactivates all functions except POWER. This button is actuated when in its extended position. For normal operation of controls, the button must remain depressed. (See also: Cabinet Components: Door Interlock Switch.)

LID 3PB

Activates the opening and closing of the lid. When pressed following tank FILL, the lid will close and the timed ultrasonic cycle will begin. After the cycle times out, the lid will automatically open.

When there is no tank FILL, the button can still open and close the lid. Yellow indicator lights when the button is engaged. (See also Toe Switch TSW.)

DEGAS 6PB

Activates the sonic generators for the removal of entrapped air from the tank solution. Yellow indicator lights when the button is engaged. Pressing this button also overrides the timer. Pressing the button again stops the process.

FILL 4PB

Activates the fill system. Button lights until the tank is filled to the proper level (7 inches).

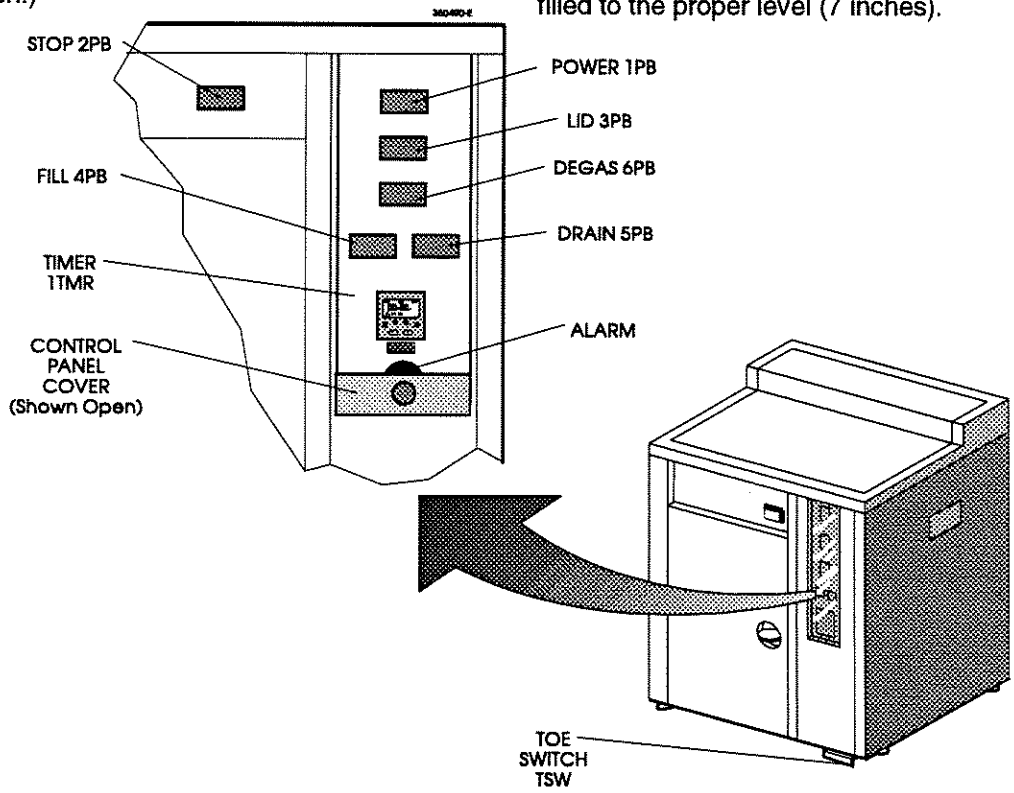


FIGURE 1–3. CONTROL COMPONENTS

DRAIN 5PB

Deactivates the heaters, allowing the liquid to cool. At the same time, it starts a 1.8-second time delay before opening the drain valve. After the tank has drained, the button will remain actuated (drain open) until either FILL, STOP, or POWER is pressed. Yellow indicator lights when the button is engaged.

TIMER 1TMR

Controls the duration of the ultrasonic wash. The timer is automatically activated (along with the ultrasonic wash) when the lid closes.

The timer may also be used manually to time the degassing process. However, this process does not stop automatically and will require pressing the DEGAS button.

NOTE ▶

The wash timer can be set for time ranges other than minutes and seconds. Refer to Appendix B: Wash Timer.

ALARM

Sounds an alarm whenever the lid is in motorized motion.

TOE SWITCH TSW

Actuated by the foot, the function of this switch is identical to that provided by the LID button described above. (Exception: If STOP is used to halt movement of the lid, only LID can restart movement. The lid will then respond to the toe switch.)

REFERENCE—PUSH BUTTONS

POWER	1PB
STOP	2PB
LID	3PB
FILL	4PB
DRAIN	5PB
DEGAS	6PB

CABINET COMPONENTS

(See Figure 1–4)

DOOR

Provides access to the service compartment beneath the tank. Turning the latch 90 degrees clockwise will open the door.

DOOR INTERLOCK SWITCH DR SW

Deactivates all washer control functions and lid movement (including POWER) if the door is opened. Pulling the switch out to its extended position will allow resumption of unit operation with the door open.

SONIC GENERATORS 1G, 2G

Provide the electrical energy necessary for the creation of ultrasonic frequencies. Both components have an ON/OFF switch and a HI/LO switch. During normal operation the HI/LO switch should be in the HI position to obtain optimal processing power.

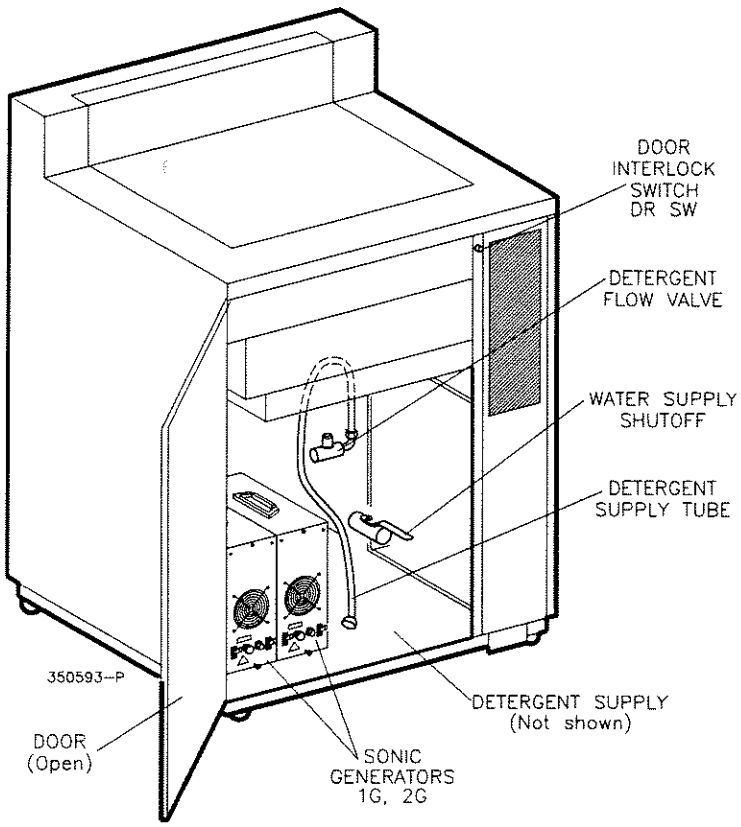


FIGURE 1–4. CABINET COMPONENTS

WATER SUPPLY SHUTOFF

Provides a means to close the water supply line manually. The valve is open when the handle is in line with the body of the valve. Turning the handle 90 degrees closes the valve.

DETERGENT FLOW VALVE

Regulates the flow of detergent into the water supply line. Turning the valve's micrometer dial clockwise will decrease the flow. Turning it counterclockwise increases the flow. The locking collar maintains the dial setting.

NOTE

The proper setting of the valve depends on various factors: type of soil, grain hardness and pressure (PSI) of the water supply. Refer to Chapter 5: Detergent Flow Rate.

DETERGENT SUPPLY TUBE

Conveys detergent to the water supply line when the end of the tube is inserted into a detergent supply container.

DETERGENT SUPPLY (Not Shown)

Store the detergent container in or near the cabinet of the unit. Use the detergent supply tube provided. Longer supply tubes may obstruct the flow of detergent.

THEORY OF OPERATION

INTRODUCTION

This chapter defines ultrasonic cleaning, describes the sequences of operation for the 2415–UW, and details the components in the unit. Refer to Figures 3–1 through 3–6 as required.

Described systems include:

- ultrasonic cleaning (degas and wash)
- motorized lid and platform
- drain
- fill
- level and temperature control
- control system

Useful notes from the operator manual are included in sections called *O&O Notes.* For detailed operating instructions, refer to *Owner and Operator Manual: Castle® 2415–UW Ultrasonic Cleaner,* Manual No. 350490.

O&O NOTES

- *Ultrasonic vibrations can contribute to the wear of some sharp, delicate, or chrome-plated items. Before processing any item in the ultrasonic washer, consult the manufacturer's guidelines to determine it's compatibility with the process.*

- *After processing, rinse instruments thoroughly to remove any soil/detergent residue.*
- *When properly conducted, ultrasonic processing will render items CLEAN. Its function is NOT to sterilize, or to eliminate the necessity for sterilization.*

ULTRASONIC CLEANING

The ultrasonic cleaning system has three main parts:

Control Panel — where the operator starts and stops the sonic action, and enters the length of the cleaning cycle.

Generators — produce electrical energy to be converted to ultrasonic energy.

Transducers — attached to the tank, convert the electrical energy from the generators into mechanical energy. This process agitates the cleaning solution.

The generators create a voltage that oscillates the transducers, expanding and contracting them many thousands of times per second. The oscillation of the transducers induces sound waves in the tank. As these sound waves pass through the cleaning solution, they increase and decrease the pressure of the cleaning solution. The constant change in pressure continuously forms and collapses millions of microscopic bubbles. This creates the scrubbing action characteristic of ultrasonic cleaners.

The scrubbing action produced by the unit occurs even in places that are difficult to clean by typical methods, yet that action is also gentle enough not to harm the items in the load.

O&O NOTES

While sonic cleaning effectively cleans and polishes instruments in a way unmatched by other methods, it does not replace the sterilization process. Instruments cleaned in the ultrasonic cleaner still must be rinsed and sterilized before being returned to use.

ULTRASONIC SEQUENCES

The unit performs two ultrasonic sequences, Degas and Wash. In Degas, the timer does not automatically shut off the cycle when it has timed down. In Wash, the timer does automatically shut off the cycle when it has timed down. Otherwise, these sequences are similar.

Degas

OPERATOR ACTION	2415-UW ACTION
Press POWER 1PS	POWER lights; components are activated
Set Timer	Unit waits
Press FILL 4PB	Detergent and water added thru auto fill procedure. When 4" is reached, low level control 2LLC, ultrasonic cycle, and heat auto energized. When 7" is reached, high level control is opened and fill stops. 2-second delay assures that level is reached before fill is stopped.
Press DEGAS 6PB	Starts the cycle and the timer. Bypasses the timer's shutoff function. Ultrasonic cycle will continue until DEGAS is pressed a second time. Recommend DEGAS time: 4–5 minutes
Press DEGAS 6PB (2nd time)	Press DEGAS 6PB (2nd time)Ultrasonic power stops.

O&O NOTES

Air and other gases are normally dissolved in the cleaning solution. These dissolved gases can impede the cleaning action. "Degassing" removes the dissolved gases and so improves the cleaning action. Degas the solution every time the tank is filled with fresh detergent-water solution.

NOTES

- *This procedure uses DEGAS 6PB to start a degassing cycle. The timer cannot stop this cycle automatically. The timer counts down the remaining time until "00M 00S" is displayed. Degassing continues until the operator again presses DEGAS 6PB.*
- *Instead of this procedure, the operator can degas the unit by running a wash cycle of 4 to 5 minutes with no load on the work tray platform. When the wash cycle is complete, the unit stops automatically.*

Wash

OPERATOR ACTION	2415-UW ACTION
Load Tray	Unit waits.
Set Timer	Unit waits.
Press toe switch TSW or LID 3PB.	Lid closes; alarm sounds when platform is moving; ultrasonics energized and timed out; platform raised and lid auto opens; alarm sounds when platform is moving.
Remove the load.	Unit waits.

MAIN COMPONENTS

Generators 1G, 2G
Produce high-voltage electrical energy for the transducers to convert into ultrasonic energy.

Transducers
Convert electric energy from the generators into ultrasonic energy, agitating the bath.

Timer 1TMR
Must be set for cycle time. Times down and turns off generators when time is up.

Isolation Transformer IT
The isolation transformer electrically isolates the sonic generators from the power line and chassis for safety reasons (it reduces leakage current). Also 1T reduces feedback of spurious signals from the generators back to the power line.

MOTORIZED LID AND PLATFORM

O&O NOTES

Keep fingers away from a closing lid. Though equipped with a safety stop, it may bruise a trapped finger.

- *Do not attempt to close a lid manually. To do so could damage the mechanical linkage connecting the lid to the lid motor.*
- *Do not pry up a closed lid that will not raise. Prying tools could damage the lid gasket or the stainless steel surfaces. (See Chapter 6, "Manually Opening A Closed Lid.")*
- *Do not place any objects on top of the lid during washer operation. The lid raises automatically at the end of a wash cycle.*

OPERATION

The operator presses LID 3PB or toe switch TSW to operate the lid. If open, the lid closes. If closed, the lid opens. An alarm sounds while the lid is in motion. Motor 1M connected to the lid via a vertical tie rod actuates the lid. Brake 1B holds the motor and lid in place while the motor is de-energized. A torque limiter prevents a closing lid from continuing to close if a finger or object is caught in the crevice. Limit switch LID UP 2LS stops lid travel when the lid is fully open; LID DOWN 1LS stops lid travel when it is fully closed.

Operator Action	2415-UW Action
Press toe switch TSW or LID 3PB	**Lid is open**: lid closes; alarm sounds when platform moving; Ultrasonics energized and timed out; platform raised and lid auto opens; alarm sounds when platform moving **Lid is closed**: platform raised and lid opens; alarm sounds when platform moving

MAIN COMPONENTS (see Figure 5–10)

Lid 3PB, Toe Switch TSW
When pressed, and the lid is down, starts the motor to raise the lid.
When pressed, and the lid is up, starts the motor to lower the lid.

Limit Switches 1LS, 2LS
LID DOWN 1LS Closed when the lid is down.
LID UP 2LS Closed when the lid is up.

Motor
Rotates in one direction to raise and lower the lid.

Torque Limiter
Tension adjuster to prevent damage to objects caught between the lid and the top of the unit.

Brake
Engages when de-energized. Holds the weight of the lid when it is open, and clamps the motor shaft when the lid is shut. Releases when it and the motor are energized to permit the motor shaft to turn.

Cam Plate
Attached to the motor shaft and linked to the drive arm. Translates the motor's one-directional motion to the drive arm so that the lid opens and shuts. A pin on the cam plate actuates the limit switches.

Drive Arm
Connects the cam plate to the lid.

Counterweights
Mounted in the rear of the lid. Help to balance the weight of the lid and platform.

Alarm
Sounds when the lid is in motion.

DRAIN

SEQUENCE

When DRAIN 5PB is pressed, heater HTR is deenergized. Time Delay Relay 1TDR is energized, causing a delay of 1.8 seconds. Then motorized drain valve 1MV opens and the tank drains by gravity. The tank overflow also connects to the drain line, toward the drain from 1MV.

MAIN COMPONENTS

Drain Valve 1MV
Motorized. Opens to empty solution from the tank.

Time Delay Relay 1TDR
Adjustable. Set to delay for 1.8 seconds after the operator presses DRAIN before activating Drain Valve 1MV.

FILL

SEQUENCE

(Refer to the piping schematic, Figure 3–3.)

When FILL 4PB is pressed, FILL solenoid 1SOL is energized and water flows to the tank. DETERGENT solenoid 2SOL is also energized, which opens the detergent fill line. On the way to the tank, the fill water flows through an injector. The injector draws detergent through the detergent fill line and into the tank.

Detergent flows from its container through the detergent fill line when both DETERGENT Solenoid 2SOL is open and water is flowing through the injector. The adjustable flow valve mounted on the intake to the injector regulates the flow of detergent into the main fill line.

MAIN COMPONENTS

Solenoid Valves

FILL 1SOL

Controls the flow of water into the tank.

DETERGENT 2SOL

Controls the flow of detergent into the tank.

DETERGENT FLOW VALVE

Controls the amount of detergent dispensed into the tank.

INJECTOR

Mounted in the fill piping, creates the vacuum that pulls detergent into the fill water.

LEVEL & TEMPERATURE CONTROL

LEVEL CONTROL

During tank fill, when the solution level reaches 4 inches, low liquid level probe 2LLC (1) activates the heaters that maintain the temperature of the solution, and (2) enables the sonic generators to run if either DEGAS 6PB or TIMER 1TMR is set.

High liquid level probe 1LLC shuts off FILL solenoid 1SOL and DETERGENT solenoid 2SOL when the solution level reaches 6¾–7 inches.

Main Components

LOW LEVEL PROBE 2LLC
Closes the circuit when the water-detergent solution level reaches 4 inches.

HIGH LEVEL PROBE 1LLC
Opens the circuit when the water-detergent solution level reaches 6¾–7 inches.

LEVEL PROBE CONTROL BOARD
Each level probe connects to a corresponding circuit on the level probe control board which is in the control box (see Figure 5–15). When the water contacts a level probe, it closes the circuit, the corresponding LED lights on the level probe control board, and other events are enabled or disabled (see the chart, *Level Probe Control Board — Delays and Functions*). When water is not contacting a level probe, it's circuit is open, the LED for that probe goes out, and other events are enabled or disabled.

The level probe control board has preset delays as follows:

- **High level probe 1LLC** requires water **contact for 2 seconds** before the circuit is closed. This delay allows for inconsistent contact between the probe and the water due to agitation during fill and ensures that the tank is filled to the proper level before shutting off the solenoid valves.
- **Low level probe 2LLC** requires **no contact for 3 seconds** before the circuit is opened. This is to reduce "chatter" in the heater contactor as the tank is being filled.

The effect of the level probes on the function of the unit depends on whether the unit is filling or draining. The chart summarizes those relationships.

During FILL, water does not contact either probe at the start (Level 1). Water first contacts Low Level Probe 2LLC (Level 2), then contacts High Level Probe 1LLC (Level 3).

During DRAIN, water contacts both probes at the start (Level 1). The water first drains below High Level Probe 1LLC (Level 2), then drains below Low Level Probe 2LLC (Level 3.)

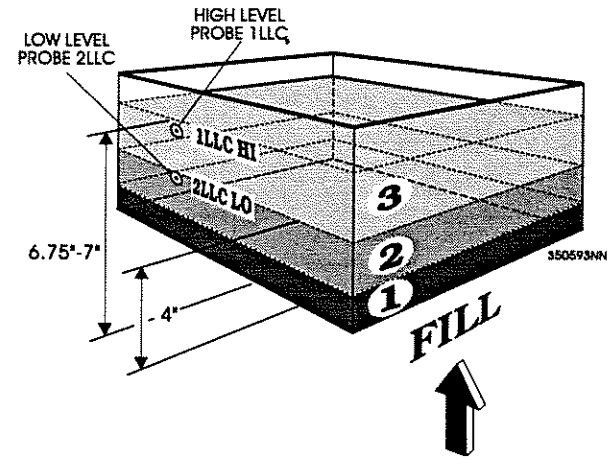


FIGURE 2–1. LEVEL CONTROL – FILLING

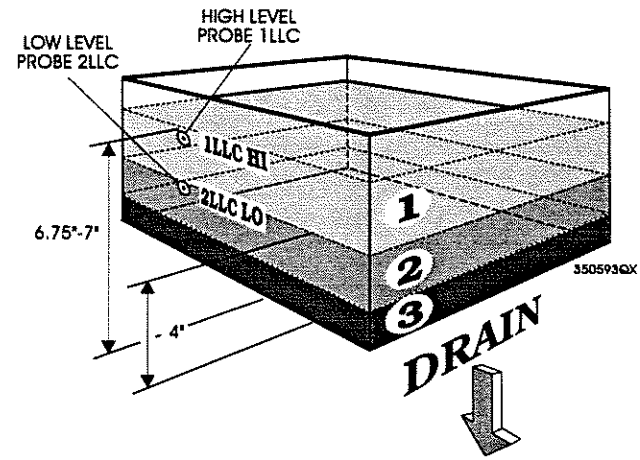


FIGURE 2–2. LEVEL CONTROL – DRAINING

Level Probe Control Board — Delay and Functions

FILLING (see Figure 2–1)

Water Level	LO Circuit 2LLC	HI Circuit 1LLC
1 — No Contact	LO LED off. HTR off; 1G, 2G disabled	HI LED off. FILL 1SOL and DET 2SOL enabled.
2 — 2LLC Contact	LO LED on, no delay. HTR on; 1G, 2G enabled.	HI LED off. FILL 1SOL and DET 2SOL enabled.
3 — 2LLC & 1LLC Contact	LO LED on. HTR on; 1G, 2G enabled.	HI LED **on after 2 sec.** contact. FILL 1SOL and DET 2SOL disabled.

NOTE

If the water breaks contact with 1LLC, 1SOL and 2SOL turn on immediately.
They will remain on for 2 seconds after the water again makes contact.
This can cause slight overfilling in some cases.

DRAINING (see Figure 2–2)

1 — 2LLC & 1LLC Contact	LO LED on. HTR on; 1G, 2G enabled.	HI LED on. FILL 1SOL and DET 2SOL disabled.
When pressed, DRAIN 5PB continues to override the level probe control board.*		
	*HTR off; 1G, 2G off.	*FILL 1SOL
2 — 2LLC Contact	***Drain 5PB continues to override the level sensor control board.***	
	LO LED on. *HTR; 1G, 2G remain off.	HI LED off, no delay. *FILL 1SOL and DET 2SOL remain off.

NOTE

If FILL 4PB is pressed to stop the draining, control returns to the level control board.
FILL begins without delay.
If the water level is above 2LLC, HTR turns on and 1G, 2G are enabled.

3 — No Contact	LO LED **off after 3 sec.** HTR disabled; 1G, 2G disabled.	HI LED off.

TEMPERATURE CONTROL

Two thermal switches, 1TAS and 2TAS, deactivate heater HTR when temperature exceeds 120° F.

Main Components

HEATER HTR
Strip heater mounted across the front of the tank.

THERMAL SWITCHES 1TAS, 2TAS
Break the circuit for heater HTR if the temperature of the tank solution exceeds 120° F (49° C).

CONTROL SYSTEM

MAIN COMPONENTS

Control Fuses 1F–4F

Protect circuits for the Door Interlock, Lid Motor, Heater, and Generators.

Control Box

TIME DELAY RELAY 1TDR
Energizes drain valve 1MV after a set delay.

CONTROL RELAYS
See Wiring Diagram, Figure 3–5.

CONTACTOR 1C
Energizes heater strip HTR.

CONTACTOR 2C
Energizes ultrasonic generators 1G and 2G.

LEVEL PROBE CONTROL BOARD
Receives input signals from level probes 1LLC and 2LLC. Sends signal to control circuit for 1LLC after a delay of 2 seconds; sends signal to control circuit for 2LLC after a delay of 0 seconds.

Level Probes 1LLC, 2LLC

1LLC is high solution level; 2LLC is low solution level.

Limit Switches 1LS, 2LS

1LS is LID UP; 2LS is LID DOWN.

Thermal Switches 1TAS, 2TAS

Break the circuit at approximately 120° F.
Close the circuit at approximately 100° F.

Isolation Transformer 1T

Mounted behind the control box, this transformer stabilizes the incoming voltage for the sonic generators.

SERVICE DATA

Figure 3–1. Component Locations 3–2
Figure 3–2. Piping Components 3–3
Figure 3–3. Piping Schematic 3–5
Figure 3–4. Electrical Schematic 3–6
Figure 3–5. Wiring Diagram 3–8
Figure 3–6. Fuses 3–12

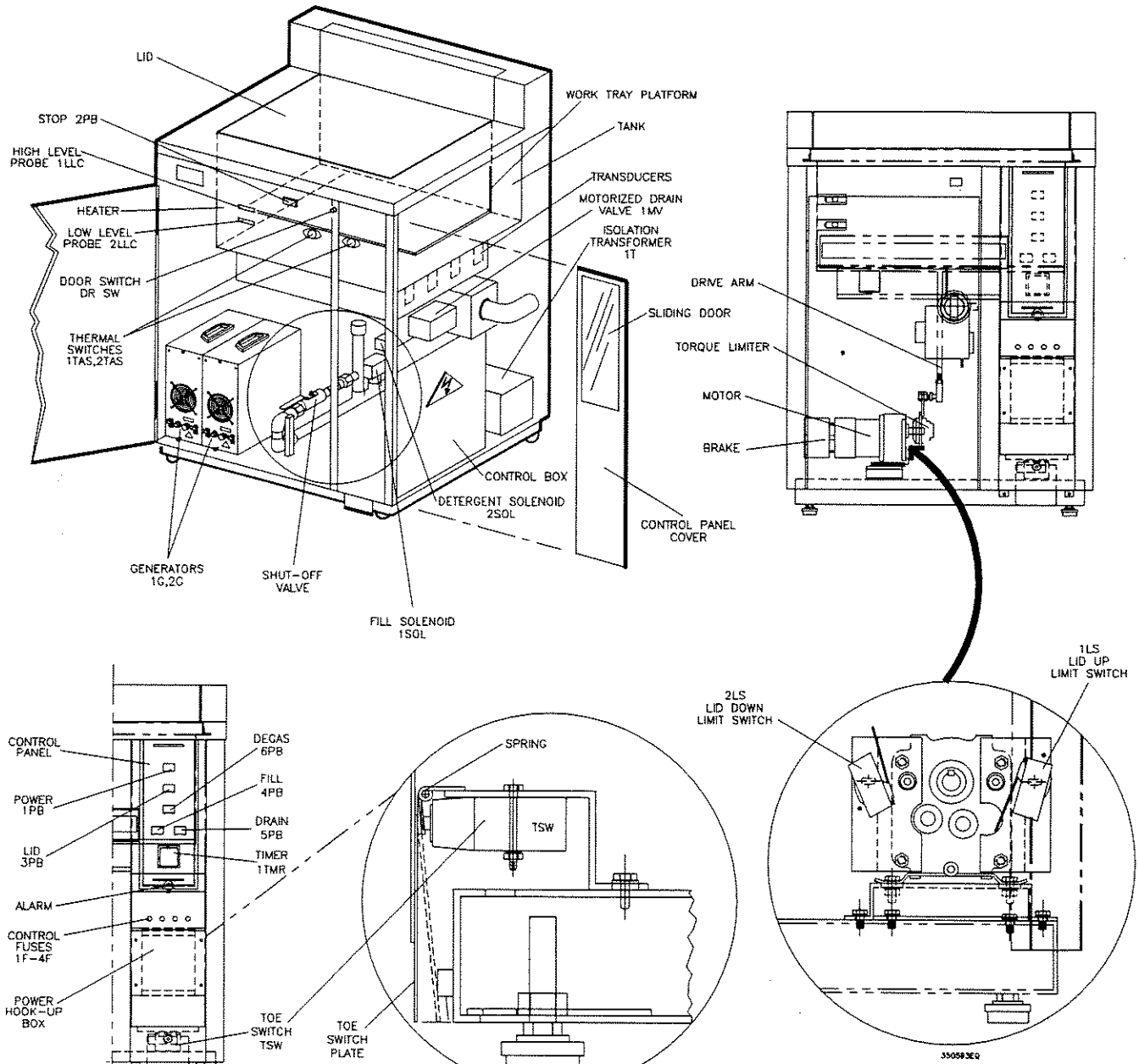


FIGURE 3–1. COMPONENT LOCATIONS

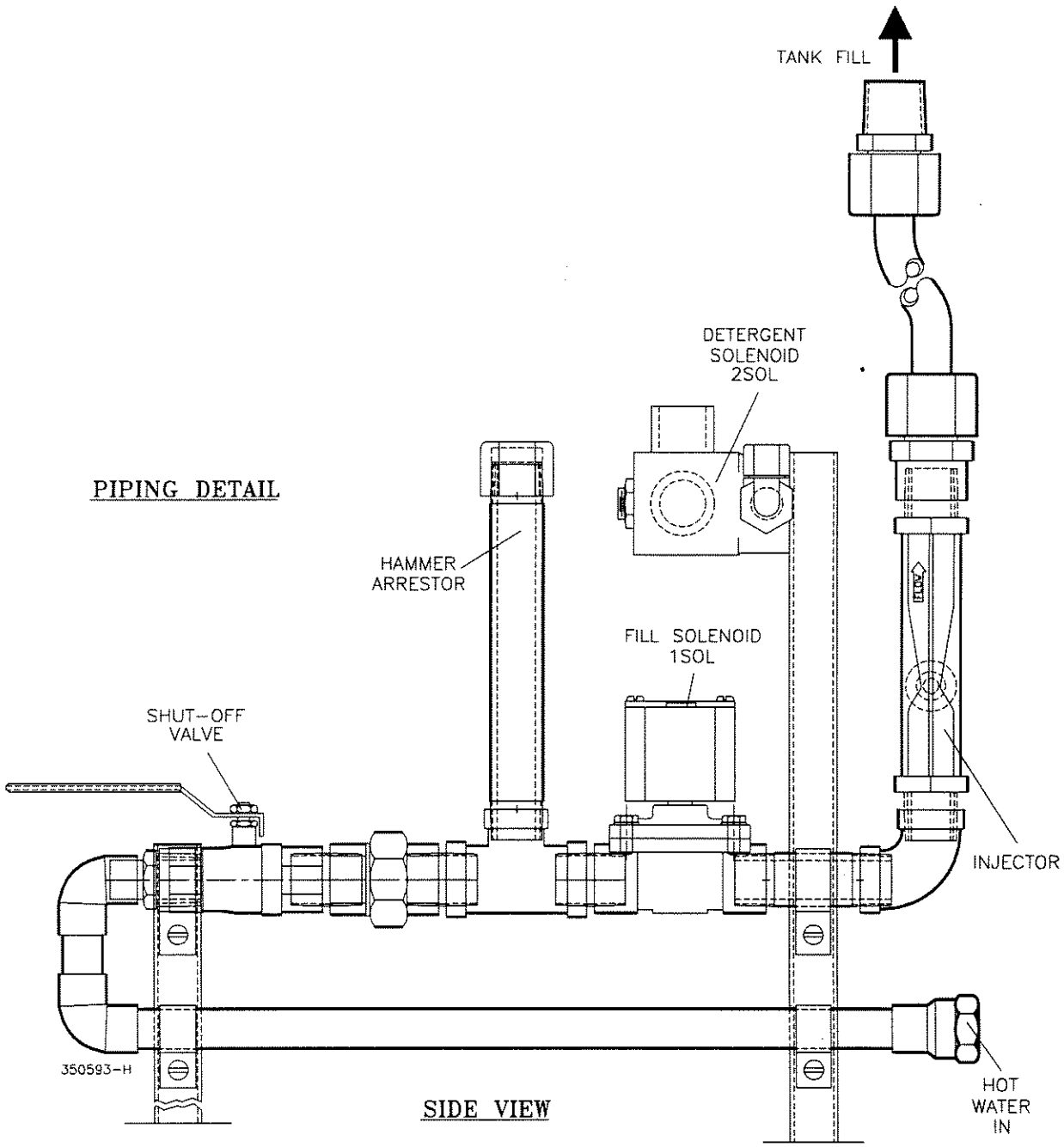


FIGURE 3–2. PIPING COMPONENTS Page 1 of 2

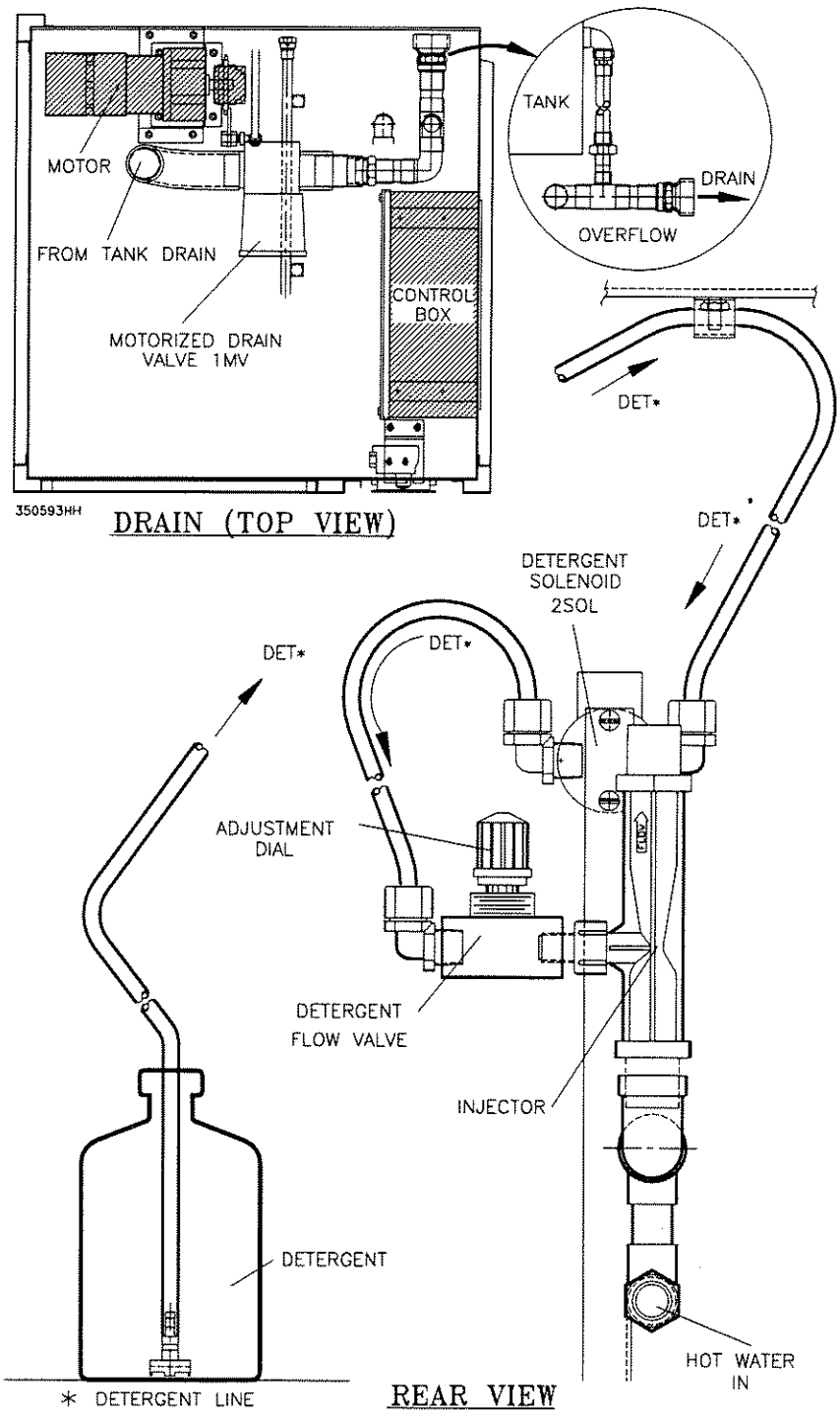


FIGURE 3–2. PIPING COMPONENTS Page 2 of 2

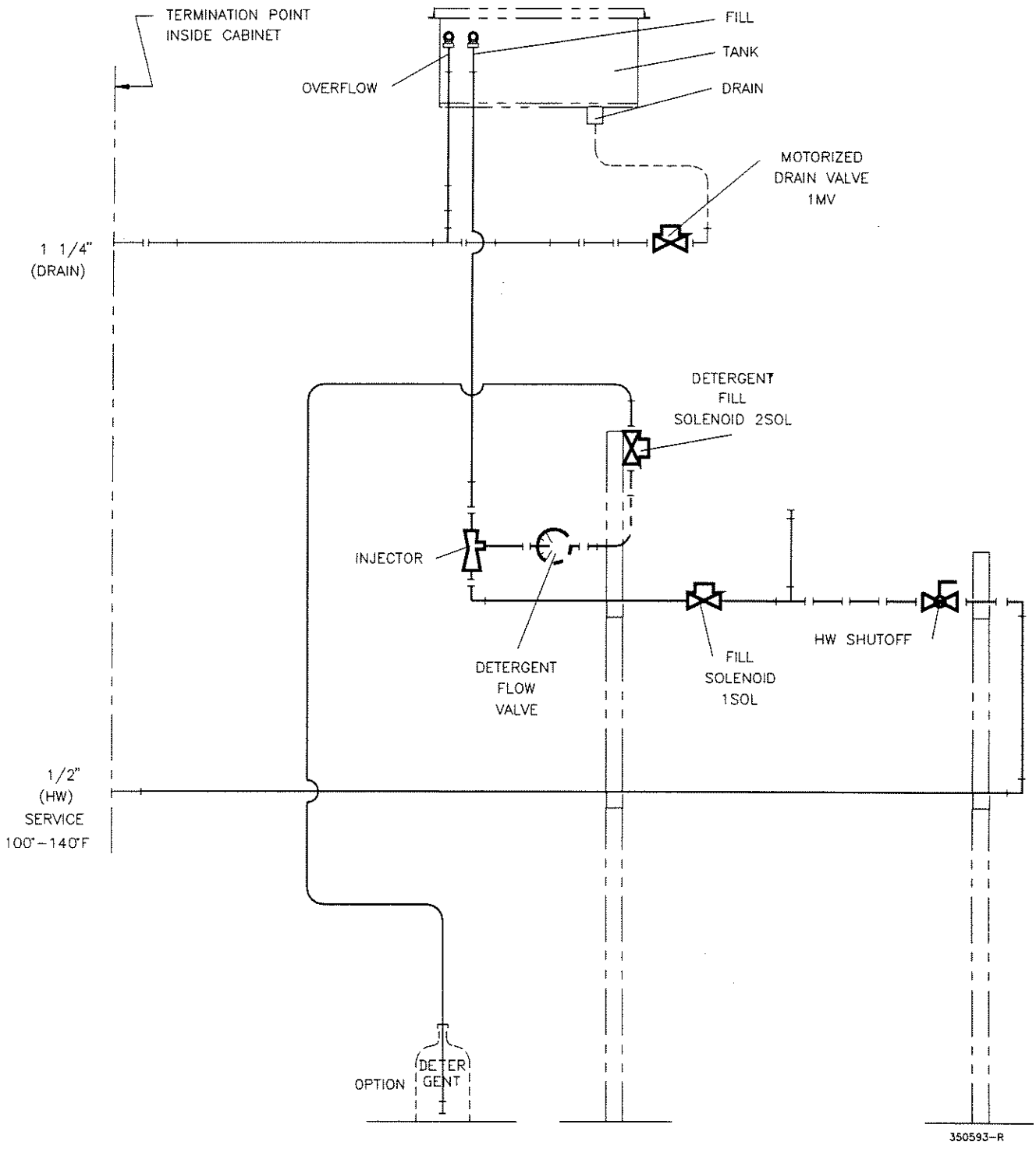


FIGURE 3–3. PIPING SCHEMATIC

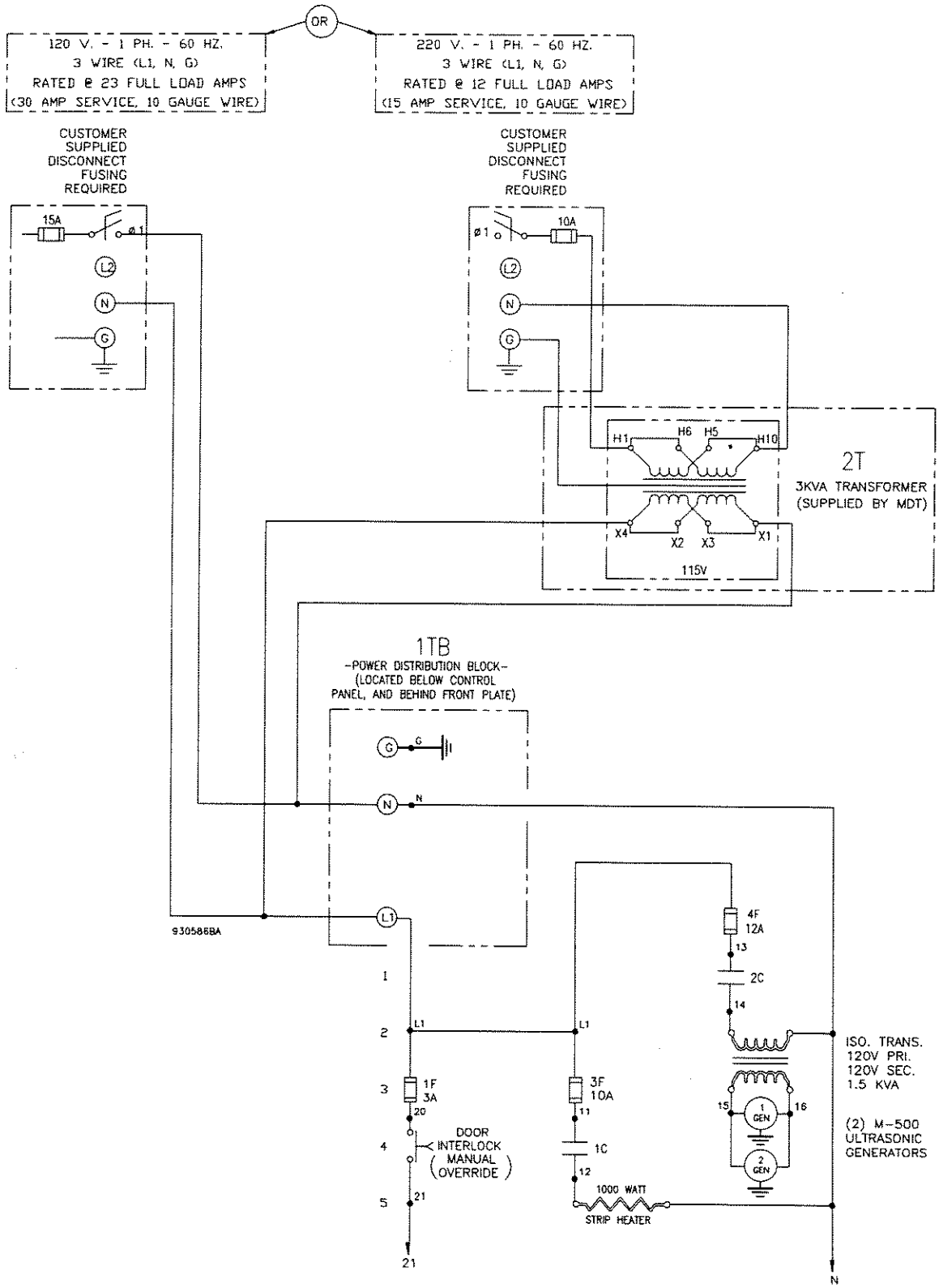


FIGURE 3–4. ELECTRICAL SCHEMATIC Page 1 of 2

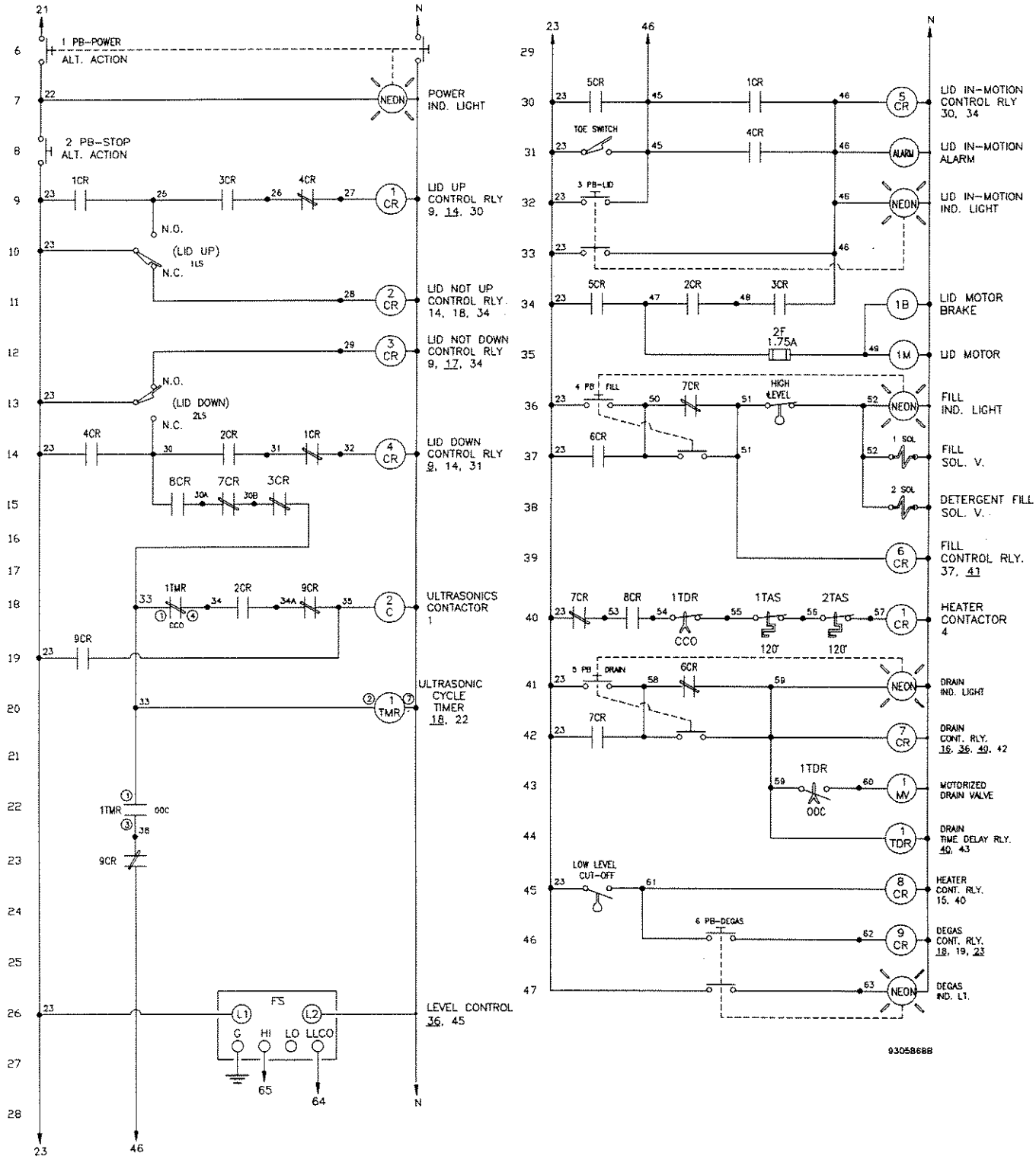


FIGURE 3–4. ELECTRICAL SCHEMATIC Page 2 of 2

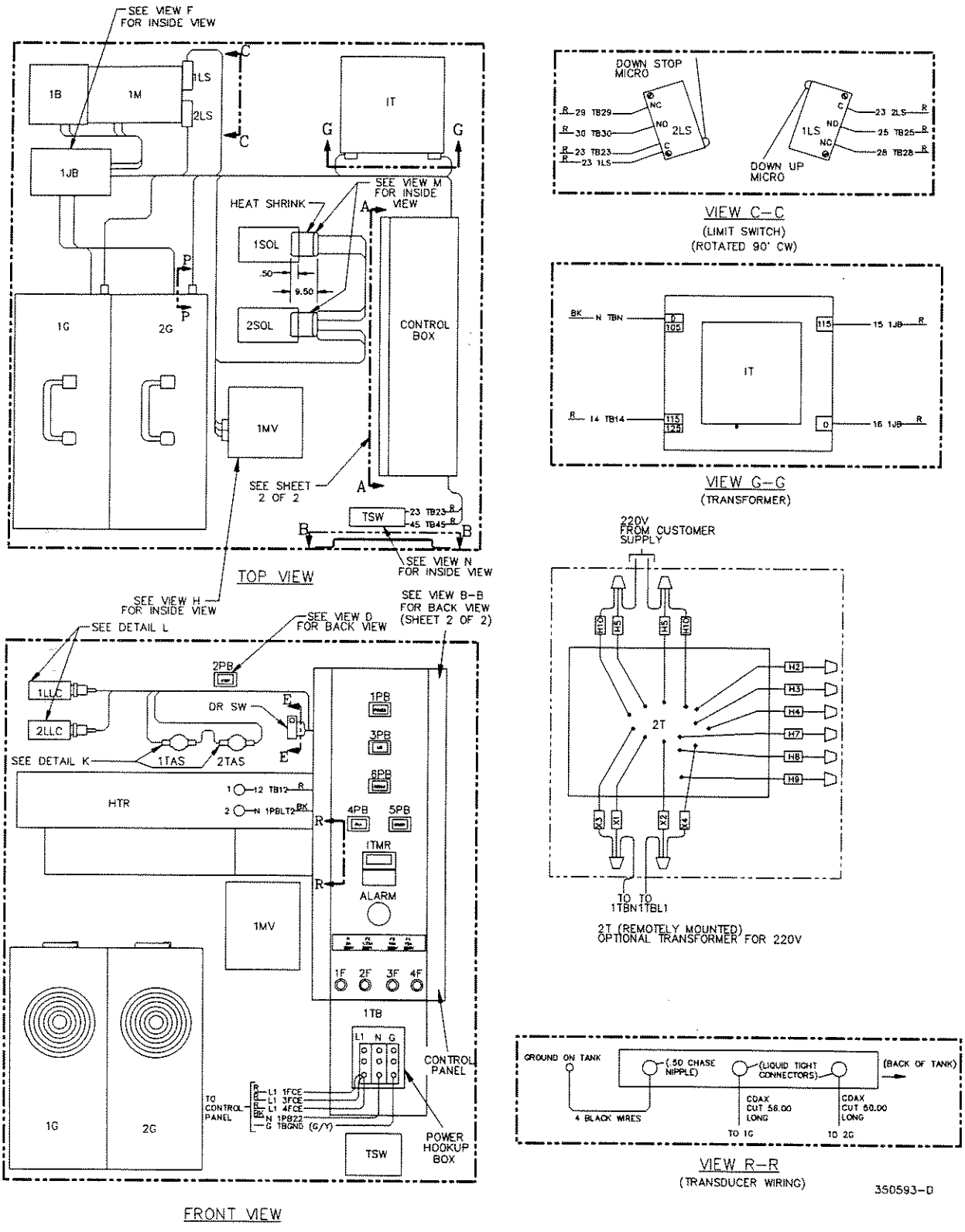
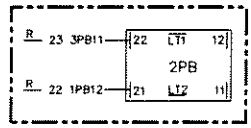


FIGURE 3–5. WIRING DIAGRAM Page 1 of 4

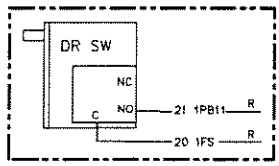


VIEW D
(STOP)

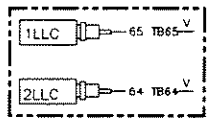
NOTES:

1) ALPHA NUMERICS SHOWN ON WIRE LEADS PART OF HOT STAMPING.
2) BRACKETS () INDICATE ACTUAL WIRE COLOR, NOT INFORMATION TO BE STAMPED ON WIRE INSULATION. THESE WIRES WILL NOT BE STAMPED.
3) THE WIRES WILL BE STAMPED WITH THE APPLICABLE COLORED STAMP AS FOLLOWS:

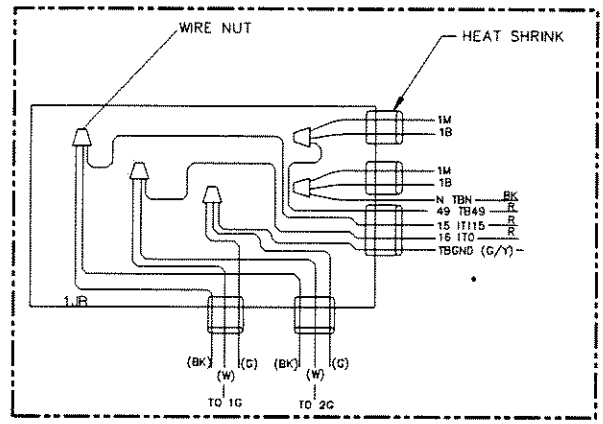
120V=R RED MARKING ON WHITE WIRE
NEUTRAL=BK BLACK MARKING ON WHITE WIRE
LOW VOLTAGE=V VIOLET MARKING ON WHITE WIRE



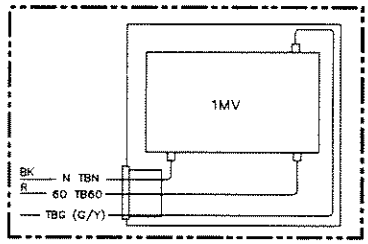
VIEW E–E
(DOOR SWITCH)



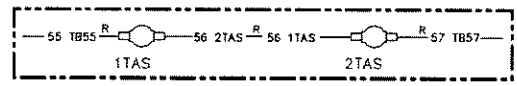
VIEW L
(SENSOR)



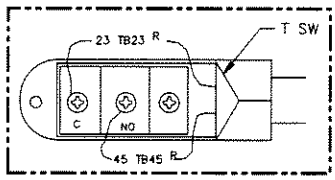
VIEW F
(JUNCTION BOX)



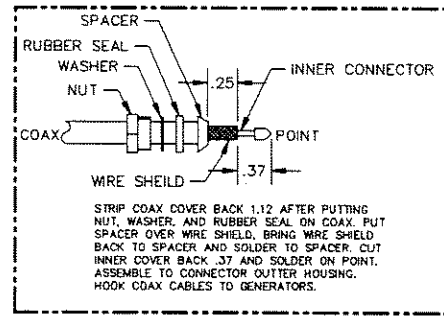
VIEW H
(MOTORIZED DRAIN VALVE)



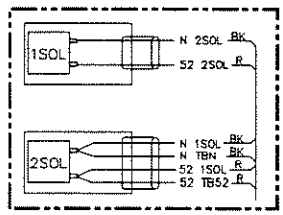
VIEW K
(THERMOSTAT)



VIEW N
(TOE SWITCH)

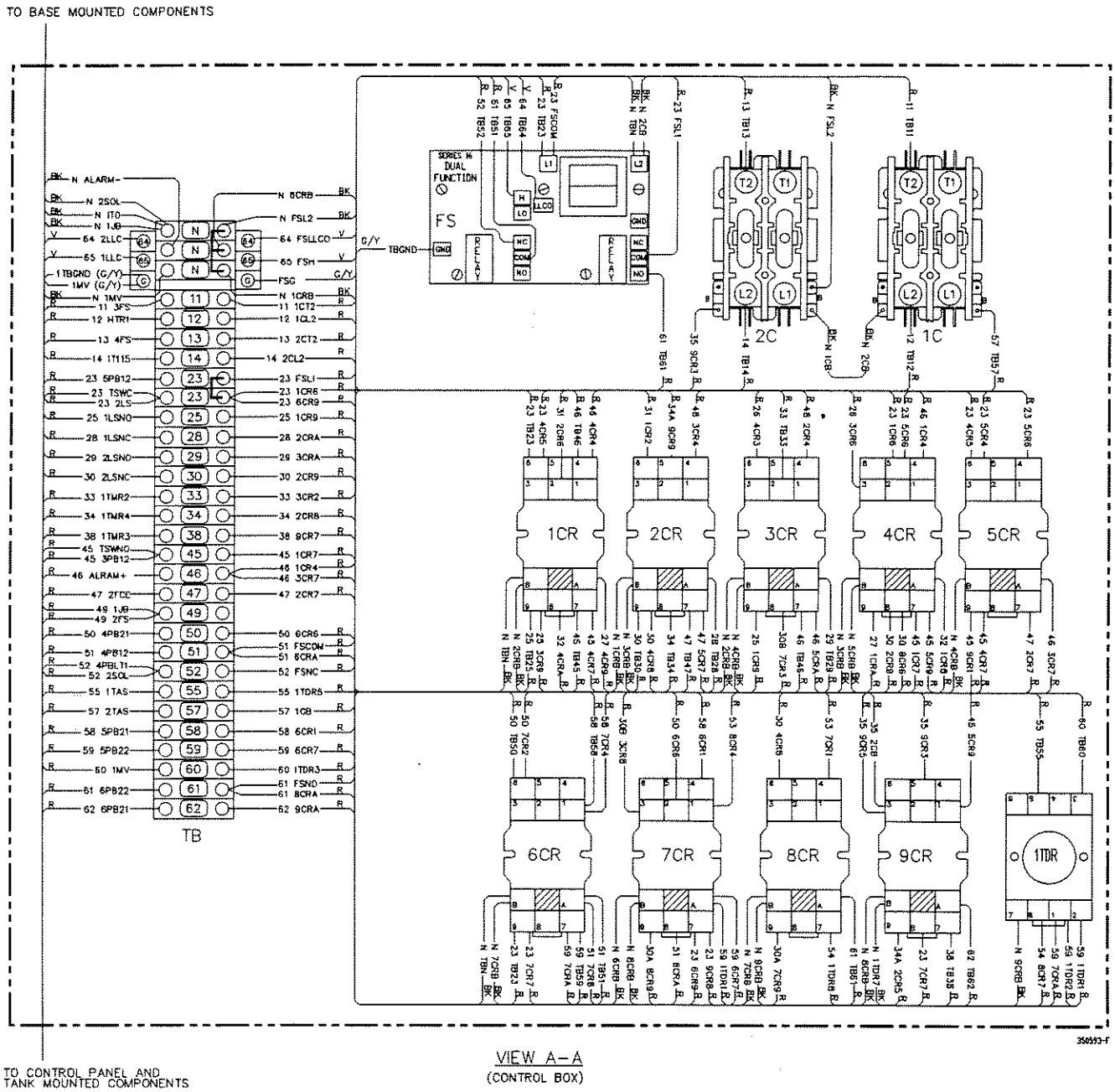

SPACER
RUBBER SEAL
WASHER
NUT
.25
INNER CONNECTOR
COAX
POINT
.37
WIRE SHEILD
STRIP COAX COVER BACK 1.12 AFTER PUTTING NUT, WASHER, AND RUBBER SEAL ON COAX. PUT SPACER OVER WIRE SHIELD, BRING WIRE SHIELD BACK TO SPACER AND SOLDER TO SPACER. CUT INNER COVER BACK .37 AND SOLDER ON POINT. ASSEMBLE TO CONNECTOR OUTTER HOUSING. HOOK COAX CABLES TO GENERATORS.

VIEW P–P
3505930D
(COAX CONNECTORS FOR BOTH COAX CABLES)



VIEW M
(FILL AND DETERGENT SOLENOIDS)

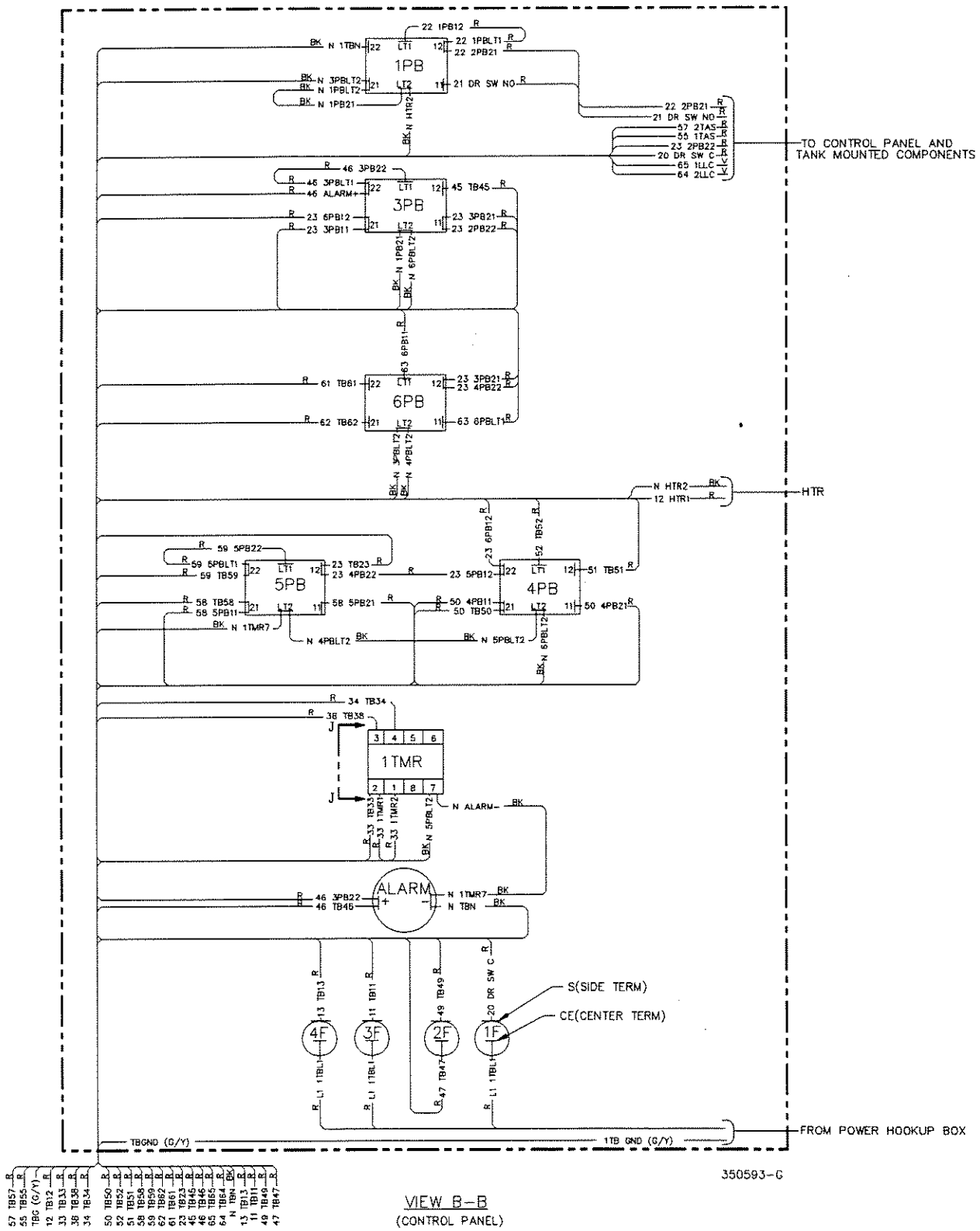
FIGURE 3–5. WIRING DIAGRAM Page 2 of 4



VIEW A–A
(CONTROL BOX)

NOTE:
CONTROL BOX WILL NOT OPERATE CORRECTLY UNLESS
JUMPERS ARE IN PLACE AS SHOWN. (⌊⌊)
DO NOT REMOVE THESE JUMPERS UNDER ANY CIRCUMSTANCES.

FIGURE 3–5. WIRING DIAGRAM Page 3 of 4



VIEW B–B
(CONTROL PANEL)

FIGURE 3–5. WIRING DIAGRAM Page 4 of 4

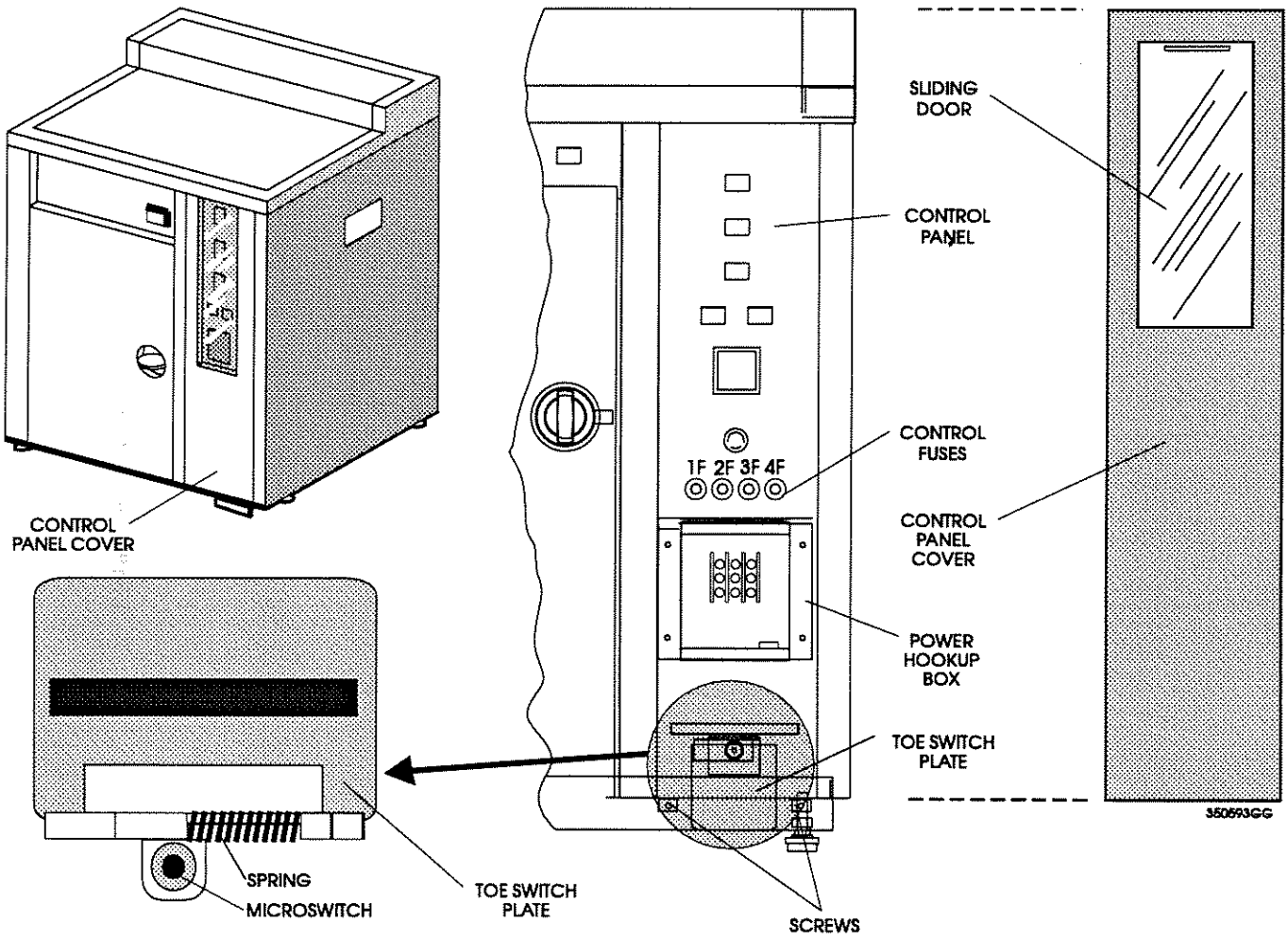


FIGURE 3–6. FUSES Page 1 of 2

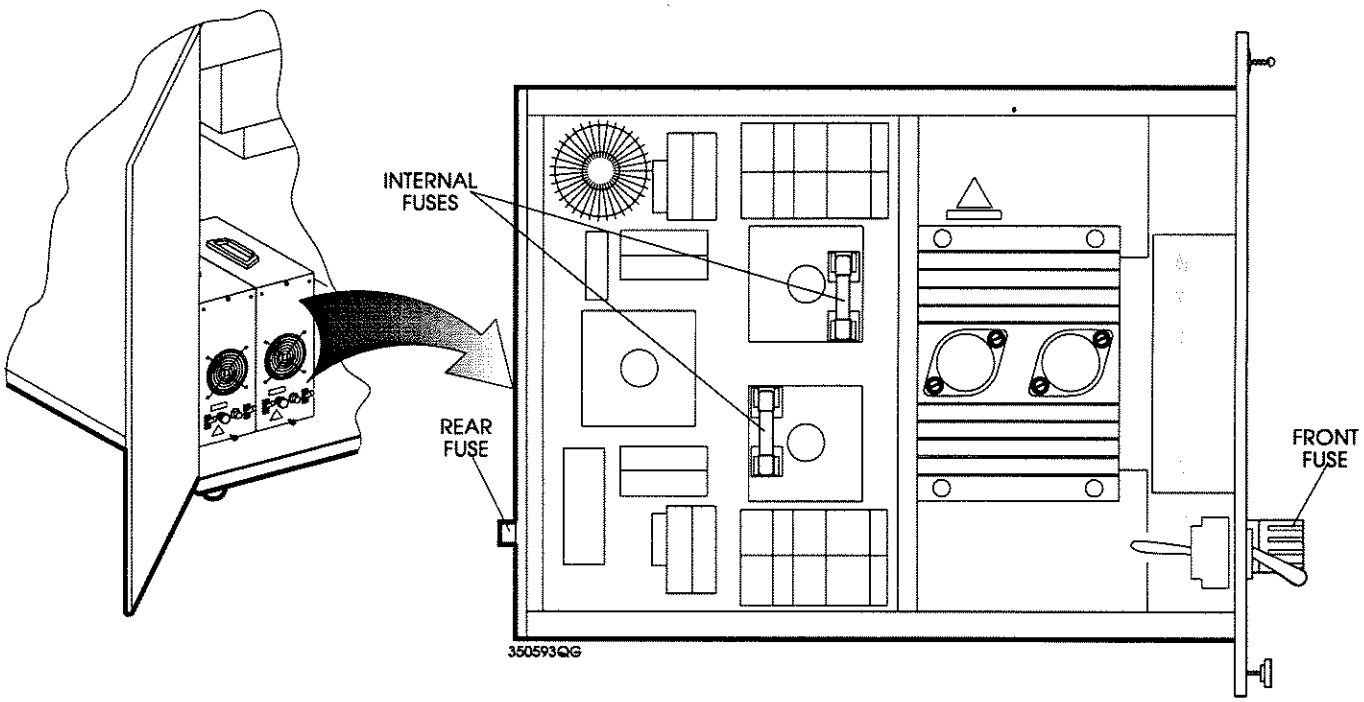


FIGURE 3–6. FUSES Page 2 of 2

NOTES

TROUBLESHOOTING

TROUBLESHOOTING CHART

NOTE

There are control fuses behind the control panel cover. There are also fuses in the sonic generators. Be sure to check all fuses during troubleshooting to avoid performing unnecessary repairs.

PROBLEM	CAUSE	SOLUTION
No power to unit when POWER 1PB is pressed.	1. Check external circuit breaker.	1. Restore power from external circuit breaker.
	2. Fuse (1F, 3A) is defective.	2. Check fuse. Replace if needed.
	3. Door switch DR SW is defective.	3. Check switch. Replace if needed.
	4. POWER 1PB is defective.	4. Check switch. Replace if needed.
No water to tank when FILL 4PB is pressed.	1. Manual shut-off valve is closed.	1. Open manual shut-off valve halfway.
	2. Fill valve 1SOL is defective.	2. Test the valve. Replace if needed.
	3. Fill control relay 6CR is defective.	3. Test the relay. Replace if needed.
	4. High level probe 1LLC or level control board is defective.	4.a. Check for loose wire in the circuit. b. Test probe 1LLC. Replace if needed. c. Test level control board. Replace if necessary.
	5. FILL 4PB is defective.	5. Check FILL 4PB. Replace if needed.
Fill does not shut off when water level reaches high level sensor port.	1. High level probe 1LLC or level control board is defective.	1. Test and replace high level probe 1LLC or level control board.
	2. Fill valve 1SOL is defective.	2. Test and replace fill valve 1SOL.

PROBLEM	CAUSE	SOLUTION
Low ultrasonic activity during processing.	1. High/Low switch on generator set to LOW.	1. Set High/Low switch to HIGH.
	2. Only one generator is operating.	2. Check generators. Turn on both. Power lights should be on. Turn off each to see if the other is still operating. If one generator is not operating, check fuses.
	3. Solution not fully degassed.	3. Degas the solution at least 4-5 minutes.
	4. Solution temperature is low.	4. a. Run an additional long cycle to achieve temperature. b. Check thermal switches 1TAS, 2TAS, heater HTR, and heater contactor 1C. Replace if necessary.
	5. Solution level is too high or too low.	5. Check solution level when full. Troubleshoot level control system.
No ultrasonic activity.	1. Fuse (4F, 15A) is defective.	1. Replace the fuse.
	NOTE ▶ *Fuse 4F should be a 15A fuse. Previous ratings of 12A are not adequate for the load. If fuse 4F is rated 12A, replace it with a 15A fuse.*	
	2. Fuses on front or rear panels of a generator are defective.	2. Replace the fuses.
	3. Internal fuse (0.5A) in the generator is defective.	3. Open the generator chassis. Replace the fuse.
Solution will not maintain temperature.	1. Fuse (3F, 10A) is defective.	1. Replace the fuse.
	2. Thermal switch 1TAS or 2TAS is defective.	2. Replace thermal switch.
	3. Defective heater HTR or contactor 1C.	3. Check heater resistance. (It should be 14.4 Ω.) Replace heater HTR or contactor 1C.
	4. Time delay relay 1TDR faulty.	4. Replace 1TDR.
No detergent supply flow, or flow appears hindered.	1. Detergent flow valve is defective.	1. Replace detergent flow valve.
	2. Water supply pressure is low.	2. Increase water supply pressure.
	3. Fill solenoid 1SOL is defective.	3. Replace fill solenoid 1SOL.

PROBLEM	CAUSE	SOLUTION
Lid will not open.	1. Fuse (2F, 1.75A) is defective. 2. Check brake. 3. Torque limiter is slipping.	1. Replace the fuse. 2. Adjust or replace if needed. 3. Adjust the torque limiter.
Lid will not close.	1. Fuse (2F, 1.75A) is defective. 2. Torque limiter is slipping.	1. Replace the fuse. 2. Adjust the torque limiter.
Lid opens and closes continuously without stopping.	Limit switches (1LS, 2LS) are broken or out of adjustment.	Check the limit switches (1LS, 2LS) . If broken or damaged, replace. If out of adjustment, adjust.
Power on to unit; nothing turns on.	Fuse (2F, 1.75A) is defective.	Replace fuse.

CONDITIONAL INSTRUCTIONS

This section reprints information for atypical situations from the *Owner & Operator Manual.*

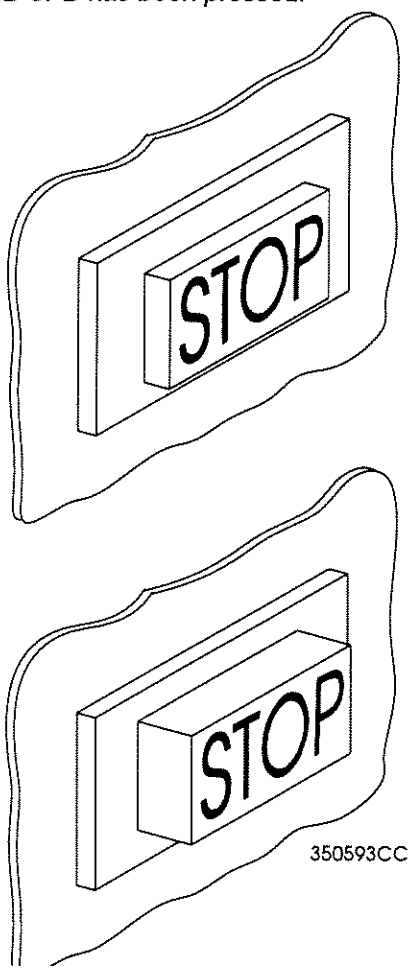
EMERGENCY STOP

PRESS **STOP 2PB** TO RELEASE IT FROM ITS SET POSITION.

Pressing STOP 2PB will deactivate all controls (except POWER 1PB) and halt any activity. Affected controls will remain inoperable until STOP 2PB is pressed to the set position.

NOTE

If STOP 2PB is used to halt movement of the lid, only LID 3PB can restart movement after STOP 2PB is reset. The lid will respond to the toe switch only after LID 3PB has been pressed.



STOP 2PB: Shown set (pressed). All controls are operable.

STOP 2PB: Shown released (extended). All controls are inoperable (except for POWER 1PB).

FIGURE 4–1. STOP 2PB POSITIONS

MANUALLY OPENING A CLOSED LID

If a closed lid fails to open when required, use the procedure in Chapter 6 to open the lid manually.

NOTE

Do not pry up a closed lid. Prying tools could damage the lid gasket or the stainless steel surfaces.

ADJUSTMENTS AND CALIBRATION

NOTE ▶

Operate the unit with a minimum of 4" of solution in the tank. Otherwise, transducers may be damaged.

INTERLOCK BYPASS (Power with Door Open)

The door interlock at door switch DSW ensures that the power turns off when the door is opened. For servicing, the interlock can be bypassed as follows.

1. Start with the unit powered off. Press POWER PB1.
   - Light on POWER PB1 goes on.
2. Open the door.
   - Light on POWER PB1 goes off.
3. Pull out the door switch plunger to its extended click-stop position. (See Figure 5–1.)
   - Light on POWER PB1 goes on.
   - The door interlock is now by-passed. Circuits are energized with the door open.

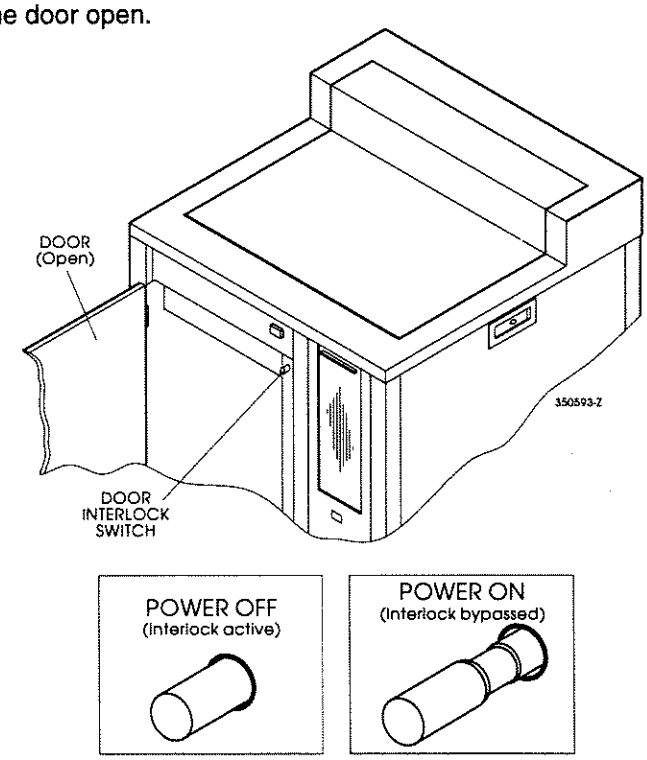


FIGURE 5–1. INTERLOCK BYPASS

DETERGENT FLOW RATE

This section describes the detergent flow valve, explains its operation, and lists procedures to obtain the correct rate of flow.

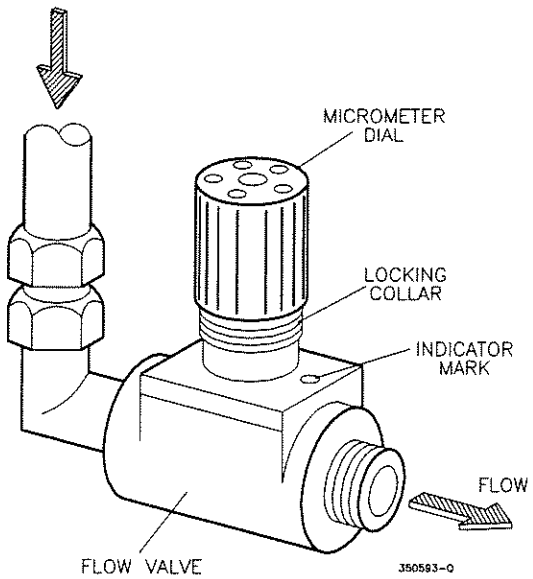


FIGURE 5–2. DETERGENT FLOW VALVE

DETERGENT FLOW VALVE

Adjustable 1/4" (0.250) needle valve that controls the amount of liquid detergent dispensed into the water supply line (see Figure 5–2).

Micrometer Dial

Adjusts the opening within the valve body.

- Turning the dial clockwise until it stops CLOSES the valve.
- Turning the dial counterclockwise for 10 complete turns completely OPENS the valve.

Ten increments (0–9) are on the dial.

- Each increment opens or closes the valve 0.0025 inch.
- One complete turn of the dial opens or closes the valve 0.025 inch.

Indicator Mark

Provides a reference on the body of the valve. When the valve is closed, the "0" increment on the dial is aligned (approximately) with this mark.

Locking Collar

When pressed down toward the valve body, the locking collar locks the micrometer dial so it cannot be rotated.

DETERGENT FLOW RATE

To determine the required detergent flow rate, you must first know the required amount of detergent. The required amount of detergent depends on (1) the type of soil to be removed and (2) the grain hardness of the water supply. The pressure of the water supply draws the liquid detergent through the flow valve by means of an injector.

The higher the required amount of detergent, the higher the necessary flow rate. But the higher the water supply pressure, the lower the flow rate necessary to supply a given amount of detergent.

SETTING THE DETERGENT FLOW RATE

One complete turn from the closed position delivers approximately 60% of maximum flow. Two turns delivers 80%; three turns, 90%. As shown in the graph (see Figure 5–3), more turns increase the rate only slightly. Ten full turns yields the maximum flow rate.

Usually, setting the dial requires only small adjustments, not complete turns. Use the following procedures to set the flow rate.

- Use "Initial Setup" when installing a new detergent flow valve, or if the existing detergent flow valve has been grossly misadjusted.
- Use "Standard Adjustment" for fine-tuning an existing detergent flow valve.

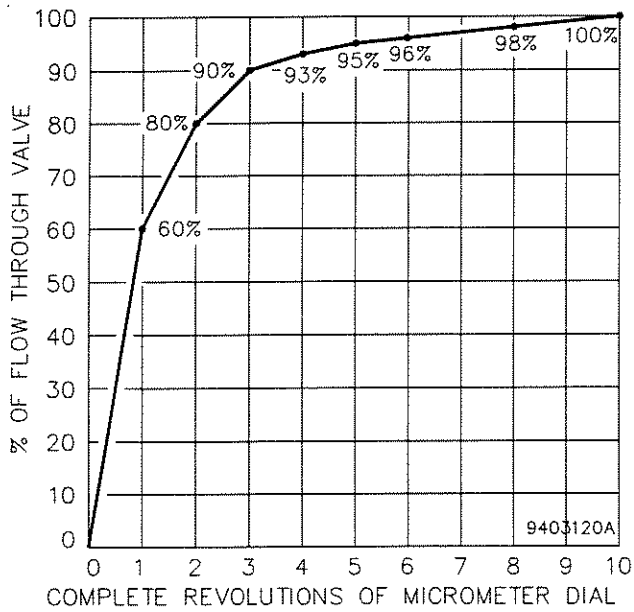


FIGURE 5–3. DETERGENT FLOW PERCENTAGES

Set the Detergent Flow—Initial Setup

CAUTION

Do not press on the detergent flow valve when adjusting the locking collar or turning the micrometer dial. Undue pressure can break off the joint with the injector.

1. Pull up the locking collar on the detergent flow valve.
2. Turn the micrometer dial clockwise on the detergent flow valve until it stops.
3. Turn the micrometer dial counterclockwise to between 0.3 and 0.4.
4. Push the locking collar down on the detergent flow valve.
5. To fine-tune the adjustment, perform "Set the detergent flow—Standard Adjustment."

Set the Detergent Flow—Standard Adjustment

1. Determine the amount of detergent required for the operational site.
2. Fill a graduated container with water. Place it on the cabinet floor. Insert the detergent supply tube into the container.
3. Leave the cabinet door open. Set the door interlock bypass so the unit will operate.
4. Note the current setting on the micrometer dial of the detergent flow valve.
5. Press the FILL button. Note the amount of liquid dispensed from the graduated container.

CAUTION

Do not press on the detergent flow valve when adjusting the locking collar or turning the micrometer dial. Undue pressure can break off the detergent flow valve at its joint with the injector.

6. Adjust the micrometer dial. Repeat Step 5.
7. Repeat step 6 until the correct amount of detergent is dispensed.
8. Remove the graduated container. Insert the detergent supply tube into the detergent container. The detergent supply is ready.

ALUMINUM FOIL TEST

This is a general test of transducer function. If the test indicates a potential malfunction, proceed with "Inspect and Test the Transducers."

1. Fill the tank with water.
2. Turn the unit ON.
3. Cut a piece of standard weight household aluminum foil large enough to cover the bottom of the tank.
4. Submerge the aluminum foil in the water, laying the foil on the bottom of the tank.
5. Set a cycle time of 30 seconds and press the START button.
6. When the cycle ends, remove the aluminum foil from the tank.
7. Hold the piece of foil up to a light. If the unit is operating properly, the sonic action should have produced visible pin holes randomly distributed across the piece of aluminum foil. If a section of the foil remained intact, it is likely that a transducer is malfunctioning. Determine under which transducer that section of foil was positioned and inspect the transducer banks with "Inspect and Test the Transducers."

INSPECT AND TEST THE TRANSDUCERS

- *DO NOT RUN the generators without the transducer cables attached. Doing so can blow the internal fuses in the generators.*
- *Prevent a transducer cable from contacting a ground while the generator is operating (like the chassis of the unit). Doing so can blow the internal fuses in the generators.*

The tank MUST be at room temperature when this measurement is taken. Otherwise, an incorrect reading will result.

1. Remove the transducer cable (BNC–type connector) from the back of one generator.

SHOCK HAZARD. Transducers can retain a charge of several hundred volts. When shorting the center conductor, use an insulated tool such as one probe of the multimeter. Otherwise, electrical shock may result.

2. At the plug end of the cable, short the center conductor to the outside sleeve of the connector. Maintain the short for about 1 minute. This will ground any residual charge left in the transducers.

3. Obtain a FLUKE Model 87 meter. Set it to the capacitance scale as follows:
   a. Turn the selector switch of the meter to the))))) Ω –|(— position.
   b. Press the blue button to switch to capacitance measurement.
      - The display shows **nF** in the lower right corner.
   c. Touch the RED **(V Ω)** probe to the center pin of the connector. Touch the BLACK **(COM)** probe to the outside sleeve of the connector. The meter automatically ranges and displays mF in the lower right corner.

4. Measure the capacitance from the center conductor to the sleeve.
   - A passing reading is .0210 to .0235 µF (21.0 to 23.5 **nF**).

NOTE ▶ *The tank MUST be at room temperature when this measurement is taken. Otherwise, an incorrect reading will result.*

5. Reconnect the cable to the generator.
6. Repeat steps 1-5 for the second cable.
7. If either cable fails the test, the transducer bank for that cable is faulty. Replace the tank.
8. If both cables pass the test, both transducer banks are working.

FILL AND HEATING TEST

1. Turn the power OFF. Connect a clamp-type ammeter either to a heater strip wire or to the wire on heater strip contactor 1C.
2. Prepare the ammeter to measure current.
   - For the FLUKE model 87 meter, with either the Fluke Y8101 or 80i–600 current probe, insert the "amp clamp" leads into **COM** (black plug) and **mA μA** (red plug) jacks.
   - Set the meter switch to the $\frac{mA}{A}$ $\overline{\underset{\sim}{=}}$ position.
   - Press the blue button to select AC current. (AC and mA will be displayed in the upper right corner of the display)
3. Bypass thermal switch 2TAS (see Figure 5–4).
4. Fill a graduated cylinder with detergent so the level reaches the topmost mark when the detergent supply line is in the graduated cylinder.

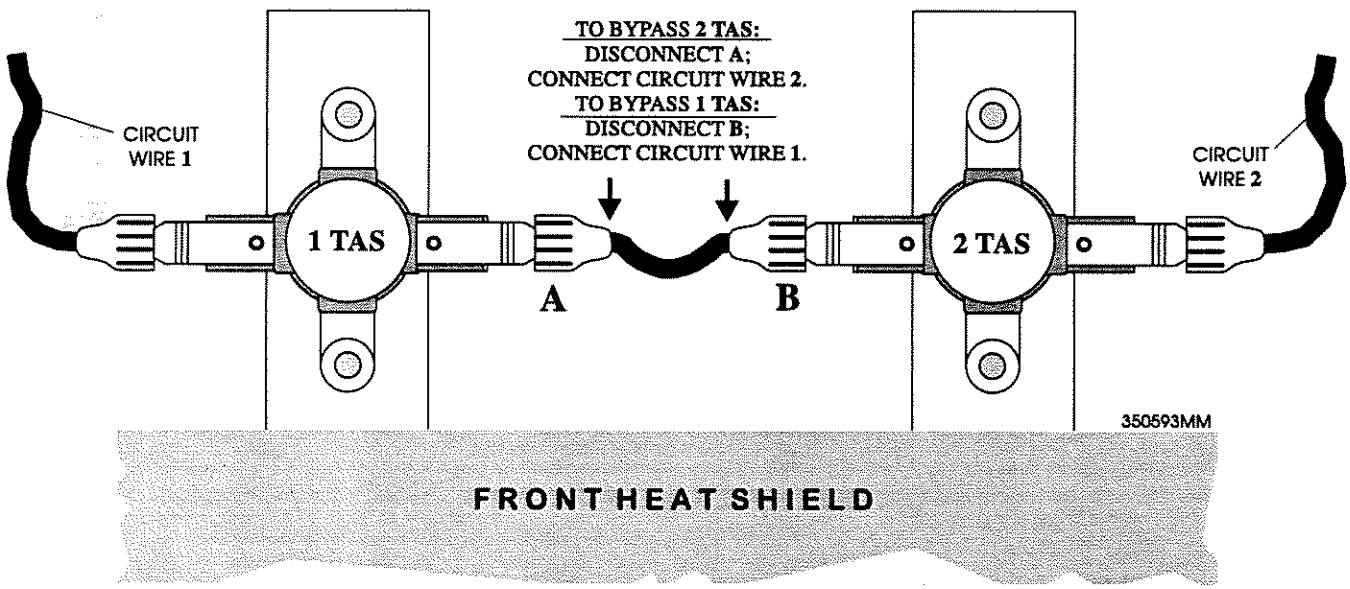


FIGURE 5–4. BYPASS THE THERMAL SWITCHES

5. Be sure the generators are switched ON. Then press POWER, press FILL, and press DEGAS.
   - The POWER button lights.
   - The FILL button lights.
   - The DEGAS button lights.
   - Water enters the tank.
   - Both generators turn ON when the water reaches low level probe 2LLC (see Figure 5–5).
   - The heater turns ON when the water reaches low level probe 2LLC.
   - The water shuts OFF soon after the level reaches high level probe 1LLC. Water level should be 6¾–7 inches deep at the center of the tank.
   - The light on FILL goes out.
6. After the heater has been on for about one minute, measure the current. It should read 7.5–9.5 amps.

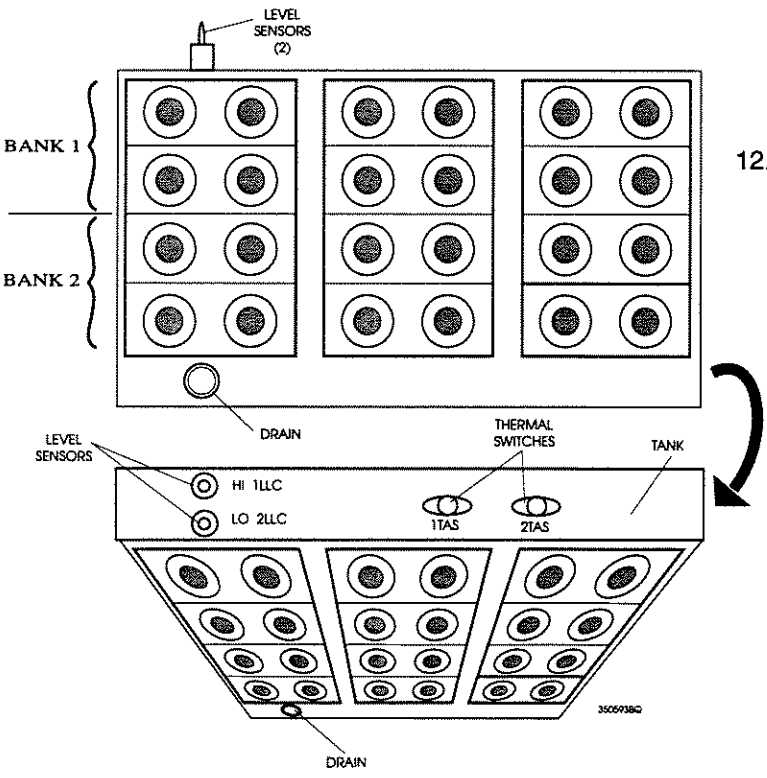


FIGURE 5–5. TRANSDUCERS AND THERMAL SWITCHES

7. The detergent fill rate was preset at the factory to remove 170–190 cc of water from a graduated cylinder. Depending on the type of detergent used, you should follow the manufacturer's fill recommendation and test with the graduated cylinder for true usage during a cycle.

   Readjust the detergent flow rate if necessary
8. Note the water temperature after the heater shuts off—it should be between 105°F and 130°F at the center of the tank. If not, replace 1TAS.
9. Press DRAIN. Let the tank drain completely.
10. Turn the power OFF, reconnect 2TAS and bypass 1TAS.
11. Turn the power ON and press FILL. When the water level in the tank reaches 3 to 4 inches, press the STOP button twice, and manually fill the tank to 6¾ –7 inches with COLD water.
    - Be sure DEGAS is on (DEGAS 6PB is lit).
    - The high level LED on the level sensor control board will light (see Figure 5–14).
    - Note the water temperature after the heater shuts off—it should be between 105°F and 130°F at the center of the tank. If not, replace 2TAS.
12. Turn the power OFF and reconnect 1TAS.

TIMER

SUMMARY

Each timer provides timing from .01 seconds to 9999 hours. The timer offers eleven programmable time ranges and six programmable operating modes. Time ranges and operating modes are selected by front panel programming. The timer can be set either to count down from the setpoint to zero, or to count up from zero to the setpoint.

SETTING THE TIMER (Programming)

Display and Controls

The liquid crystal display (LCD) gives detailed information for both programming and operation (see Figure 5–6). The controls are under the display.

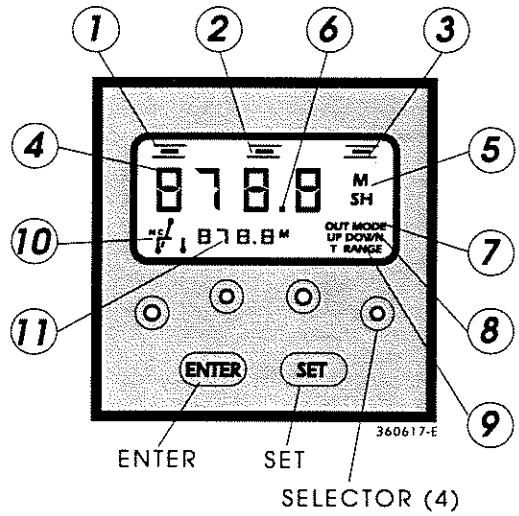


FIGURE 5–6. LCD DISPLAY & CONTROLS

DISPLAY FEATURES

1. POW—Lights when service voltage is on.
2. Closed control switch indicator (not used)
3. RUN—Flashes when timer is timing.
4. Actual time (4 digits)
5. Time range—Hours, Minutes, Seconds
6. Decimal point
   Programming Indicators (7–9)
7. OUT MODE—Timer Mode indicator
8. UP DOWN—Time Direction indicator
9. T RANGE—Time Range indicator
10. Relay Status indicator—shows NO or NC
11. Run time setpoint (4 digits)—shows the run time that is set by the operator.

SETTING THE RUN TIME

Each selector sets one of the digits in the run time setpoint display.

Pressing a selector increases the corresponding digit by one.

To set the run time, press the selectors until the desired setpoint appears in the run time setpoint display.

Recommended Run Time Setpoints

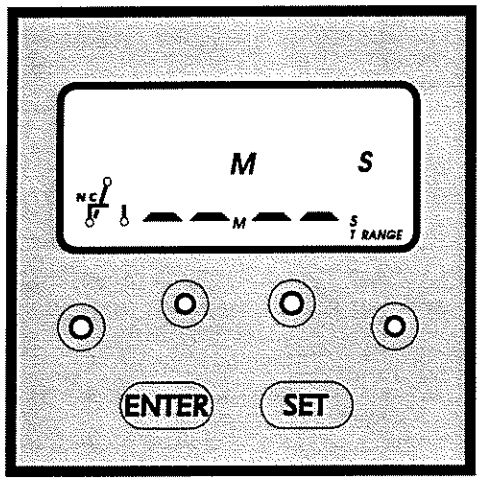
Rinse	3–4 min.
Dry	10–14 min.

PROGRAMMING MODE

The timer normally operates in Run Mode. To set the timer for range, time direction, and timer mode, use Programming Mode.

1. To enter Programming Mode: At the same time, press and hold ENTER and SET. The display will change. ***T RANGE*** will appear.
2. To exit Programming Mode at any time and return to Run Mode, press ENTER.

SETTING THE RANGE



360617-F

SCROLLING:

- - . - - S (SECONDS)
- - - . - S (SECONDS)
- - _ - - S (SECONDS)
- - M - - S (MINUTES: SECONDS)
- - . - - M (MINUTES)
- - - . - M (MINUTES)
- - - - M (MINUTES)
- - H - - M (HOURS: MINUTES)
- - . - - H (HOURS)
- - - . - H (HOURS)
- - - - - H (HOURS)

FIGURE 5–7. TIME RANGES

1. Be sure *T RANGE* shows in the LCD display. (If it does not, press SET repeatedly until it does.) Then press any of the selectors to scroll the display to the desired range (see Figure 5–7).

NOTE

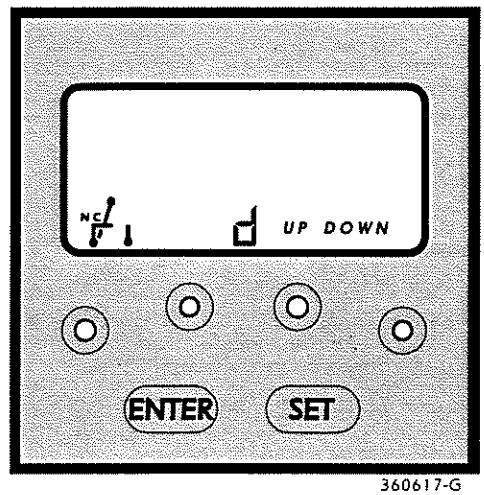
Be sure to watch the decimal point in the run time setpoint display (Figure 5–6, Item 11). Do not be confused by the larger decimal point (Figure 5–6, Item 6).

2. The recommended range for 2415 model units is

   _ _ M _ _ S.

3. When the display shows the desired range, press SET. *UP DOWN* will appear (see Figure 5–8).

SETTING THE DIRECTION



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U :UP

d :DOWN

FIGURE 5–8. TIME DIRECTION

1. Be sure *UP DOWN* shows in the LCD display. (If it does not, press SET repeatedly until it does.) Then press any of the selectors to display either:

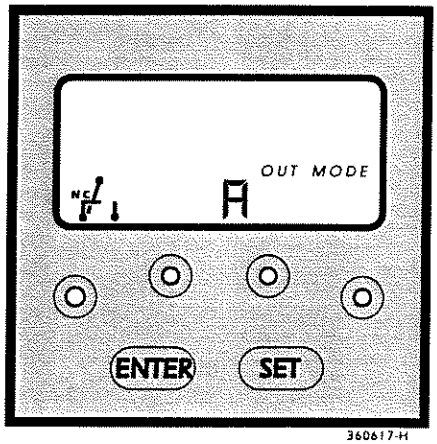
   d—Display will time **down** from the setpoint to zero

   U—Display will time **up** from zero to the setpoint

2. The recommended direction for 2415 model units is ***d***.

3. When the display shows the desired direction, press SET. ***OUT MODE*** will appear (see Figure 5–9).

SETTING THE TIMER MODE



SCROLLING:

A: ON Delay
H: Interval
b: Single Shot
C: Delay on Release
d: Repeat Cycle (Off time first)
dl: Repeat Cycle (On time first)

FIGURE 5–9. TIME MODES

NOTE ▶

If the timer is set to an incorrect mode, the unit will not operate. Be sure to select the correct mode for your unit.

1. Be sure OUT MODE shows in the display. (If it does not, press SET repeatedly until it does.) Then press any of the selectors to scroll the display to the desired mode.
2. The correct mode for 2415 model units is ***A***.
3. When the display shows the desired mode, press ENTER. This exits Programming Mode and returns to Run Mode.

LID

LID POSITION

Power must be on for these procedures. To turn on power, perform the *Interlock Bypass* (see Figure 5–1).

To adjust the lid position so that the lid is both sealing properly when closed and also at the proper angle when open, use *Adjust the Drive Arm*. To adjust so that limit switches 1LS and 2LS engage at the proper times, use *Adjust the Limit Switches*. For motor and lid components, see Figure 5–10.

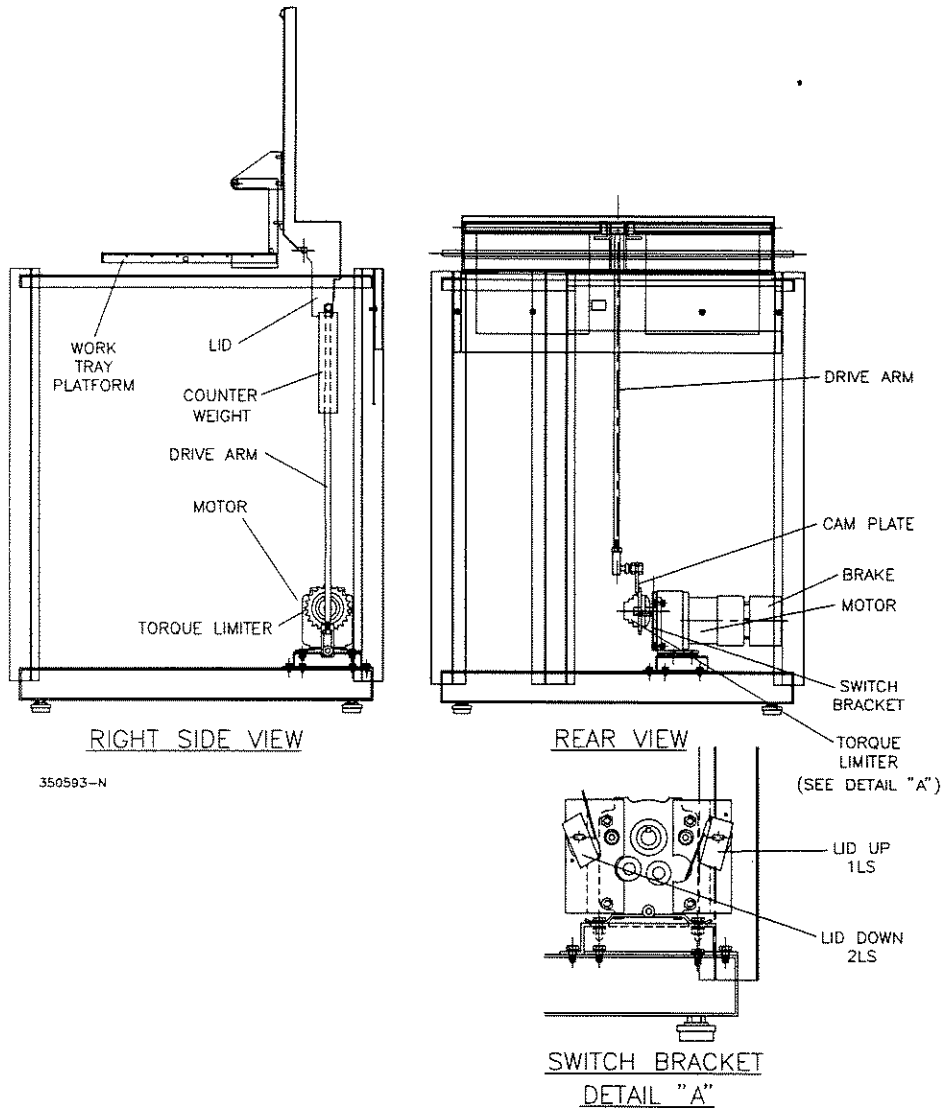


FIGURE 5–10. MOTOR AND LID COMPONENTS

ADJUST THE DRIVE ARM

With the drive arm properly adjusted, pressing LID should open and close the lid completely, and with little fallback of the open lid.

- When the lid is closed, the cam plate will be "dead center up" ("12:00").
- When the lid is open, the cam plate will be "dead center down" ("6:00") .

At the linkage to the cam plate, adjust the length of the drive arm (see Figure 5–11.)

WARNING

SHOCK HAZARD. Wiring to the limit switches is exposed. Avoid contacting the wiring or electric shock may result.

1. Open the lid.
2. Loosen the jam nut on the drive arm. Loosen the jam nut on the shaft.

NOTE

Mildly pressing the open lid toward the back of the unit removes the weight from the drive arm. This makes it easier to unscrew the shaft from the cam plate.

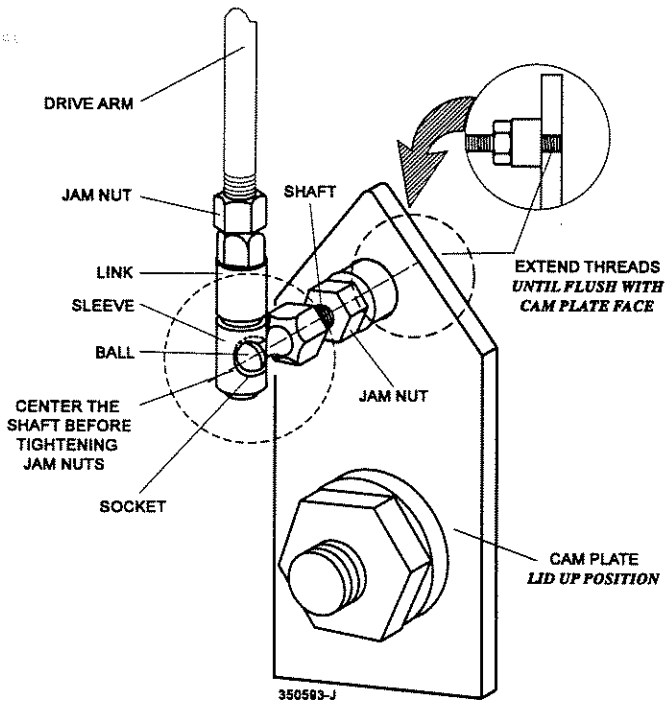


FIGURE 5–11. ADJUST THE DRIVE ARM

3. Disconnect the shaft from the cam plate.
4. To change the length of the drive arm, turn the link in *full turns only.*
   - Clockwise turns **shorten** the drive arm
   - Counterclockwise turns **lengthen** the drive arm
   - *For the first adjustment:* leave 1/2" of the thread showing on the drive arm. On subsequent adjustments, if required, make only minor changes.

CAUTION

The end of the shaft must be flush with the rear face of the cam plate, and the drive arm in a vertical position. Otherwise, side pressure will cause premature wear in the bushing at the top of the drive arm.

5. Connect the shaft to the cam plate. The threads must penetrate through all threads of the cam plate, but they must not extend out the other side. Be sure the drive arm "floats" in a vertical position, and is not angled either away from or toward the motor.
6. Turn on POWER and press LID to test the adjustment.
   - Observe the motor during motion and upon closing the lid. If the motor flexes its mounting bracket and raises up from it, the drive arm is too long.
   - Press on the corners of the lid after it has closed. If there is downward movement, the lid is not sealing. The drive arm is too short.
7. Repeat steps 2-6 until the drive arm is adjusted.
   - If pressing on either front corner gives no downward movement, and if the motor has not flexed its mounting bracket, the drive arm is properly adjusted.
8. Secure the drive arm.
   a. Center the ball of the shaft in the socket on the link. Be sure the sleeve is not caught in the joint. This minimizes wear.
   b. Snugly tighten the jam nut on the drive arm.
   c. Snugly tighten the jam nut on the shaft.

ADJUST THE LIMIT SWITCHES

CAUTIONS

- *DO NOT BEND the arm of a limit switch. This could ruin the switch. To adjust a limit switch, move the body of the switch along its adjustment slot.*
- *Allow the cam plate to turn only in the direction shown (CW). Turning the cam plate toward the FRONT of the unit (CCW) will break the micro-switches.*

The pin on the cam plate must contact each limit switch at the proper time (see Figure 5–12).

- When the lid is down, the cam plate will be "dead center up" ("12:00"). The pin on the cam plate must close LID DOWN switch 2LS. A small click is audible when the switch is closed.
- When the lid is up, the cam plate will be "dead center down" ("6:00"). The pin on the cam plate must close LID UP switch 1LS. A small click is audible when the switch is closed.

1. To adjust a limit switch:
   a. Loosen the screws that hold the limit switch to the mounting bracket.
   b. Pivot the switch to the proper angle.
   c. Tighten the limit switch screws to the mounting bracket.
2. Press the LID switch or the toe switch to lower and raise the lid:
   - The lid should open and close smoothly, move down from a full upright position with a **minimum of backward motion**, and **close flush** with the cabinet surface.
   - The alarm should sound when the lid is in motion.
   - If not, repeat step 1.

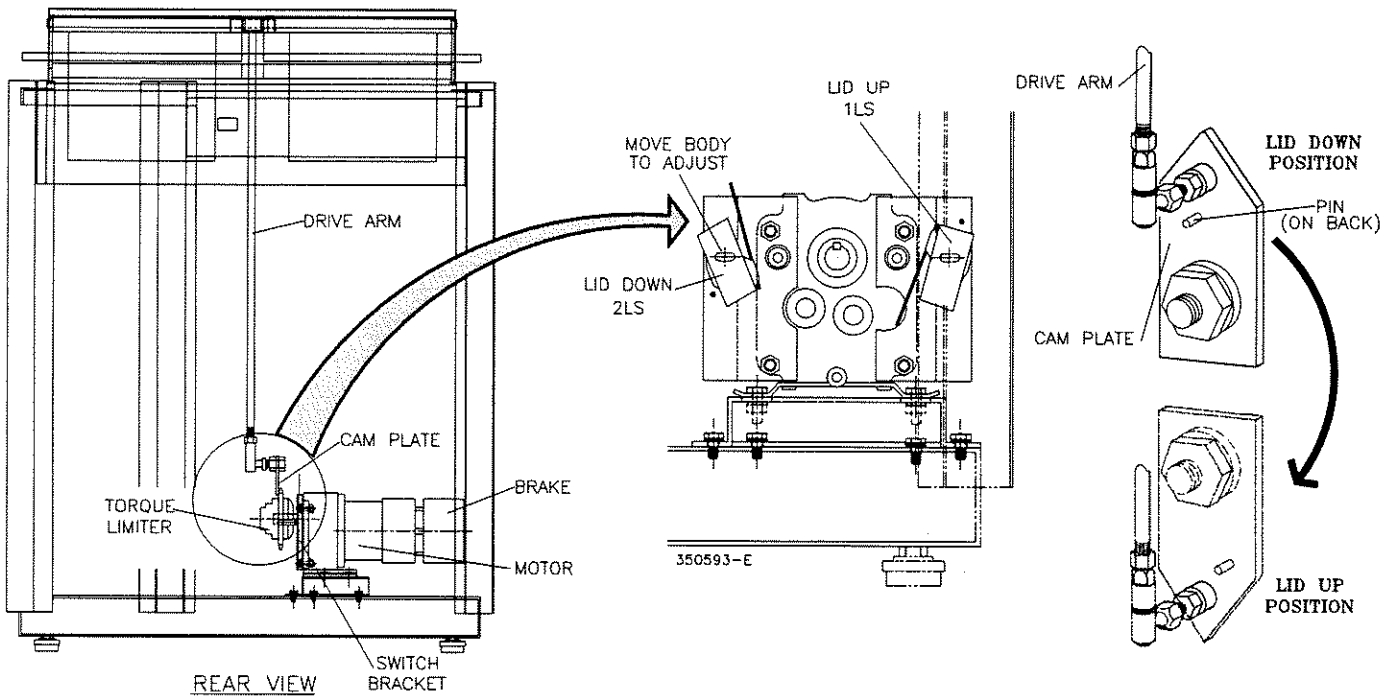


FIGURE 5–12. ADJUST THE LIMIT SWITCH

ADJUST THE TORQUE LIMITER

The torque limiter provides safety for the operator. When the lid encounters resistance, *e.g.*, if an object or hand is caught between the lid and the top of the unit, the torque limiter slips. This prevents the lid from continuing to close. If the torque limiter is out of adjustment, lid closing is erratic if it is too loose, and the safety feature is lost if it is too tight.

1. **Test the lid status**: Press LID to open the lid. Press LID again. With the lid closing, try to stop its travel by holding the lid. If travel will not stop easily, the torque limiter is too tight.
2. Unbend the two locking ring tabs from over the adjusting nut (see Figure 5-13).
3. Press LID. The lid will begin to lower.

CAUTIONS

Be sure that limiter slipping BEGINS only when the lid is lowering.

4. ONLY WHEN THE LID IS LOWERING, loosen the adjusting nut by ¼-turns, until the limiter slips.
   - If the lid fully closes before slipping occurs, press LID to raise the lid. Press LID again to begin lowering. Continue to loosen the adjusting nut by 1/4–turns.
5. When the limiter slips and lid motion stops, manually raise the lid to the up position. The motor will continue to run.
6. ONLY WHEN THE TORQUE LIMITER IS NEW: When the limiter slips and lid motion stops, "run in" the torque limiter by letting the motor run for a minimum of four minutes.
7. Center an instrument tray with a 19-pound load on the work platform.
8. Press LID to lower the lid. Tighten the torque limiter adjusting nut by ¼-turns, ONLY WHEN THE LID IS LOWERING, until the limiter stops slipping and the lid continues to lower.

CAUTION

Be sure that limiter slipping ENDS only when the lid is lowering.

9. Press LID to raise the lid. After the lid has raised, remove the instrument tray and load.
10. Press LID to lower the lid. Watch for even operation as the lid lowers.
11. IF THE LID STICKS OR SLIPS WITH NO LOAD: ONLY WHEN THE LID IS LOWERING, tighten the torque limiter adjusting nut by 1/16-turns until lid travel is smooth.
12. If problems persist, there may be oil on the friction surfaces. Check for and remove oil on any friction surface (both sides of each friction facing, both sides of the cam plate, facing side of the pressure plate and the hub).
13. Bend the two locking ring tabs over the adjusting nut.

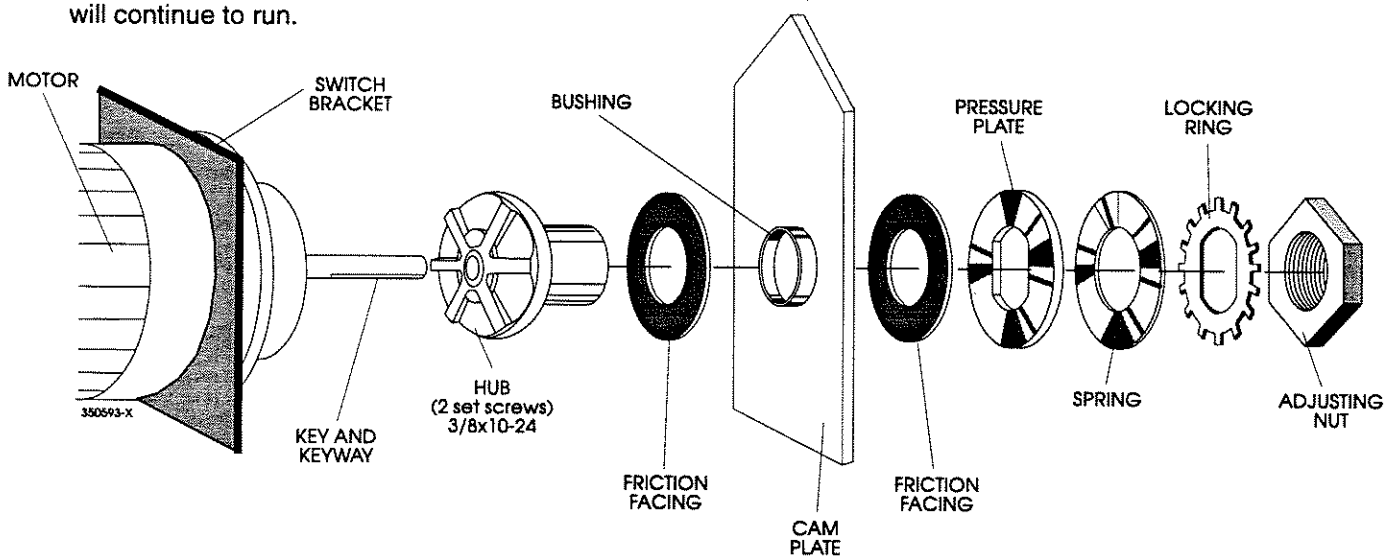


FIGURE 5–13. TORQUE LIMITER

MOTOR

LUBRICATION

The motor is lubricated for life at the factory. Periodic relubrication is not required under normal conditions.

CLEANING

Periodically use a vacuum cleaner to clean dirt accumulations, especially in and around vent openings.

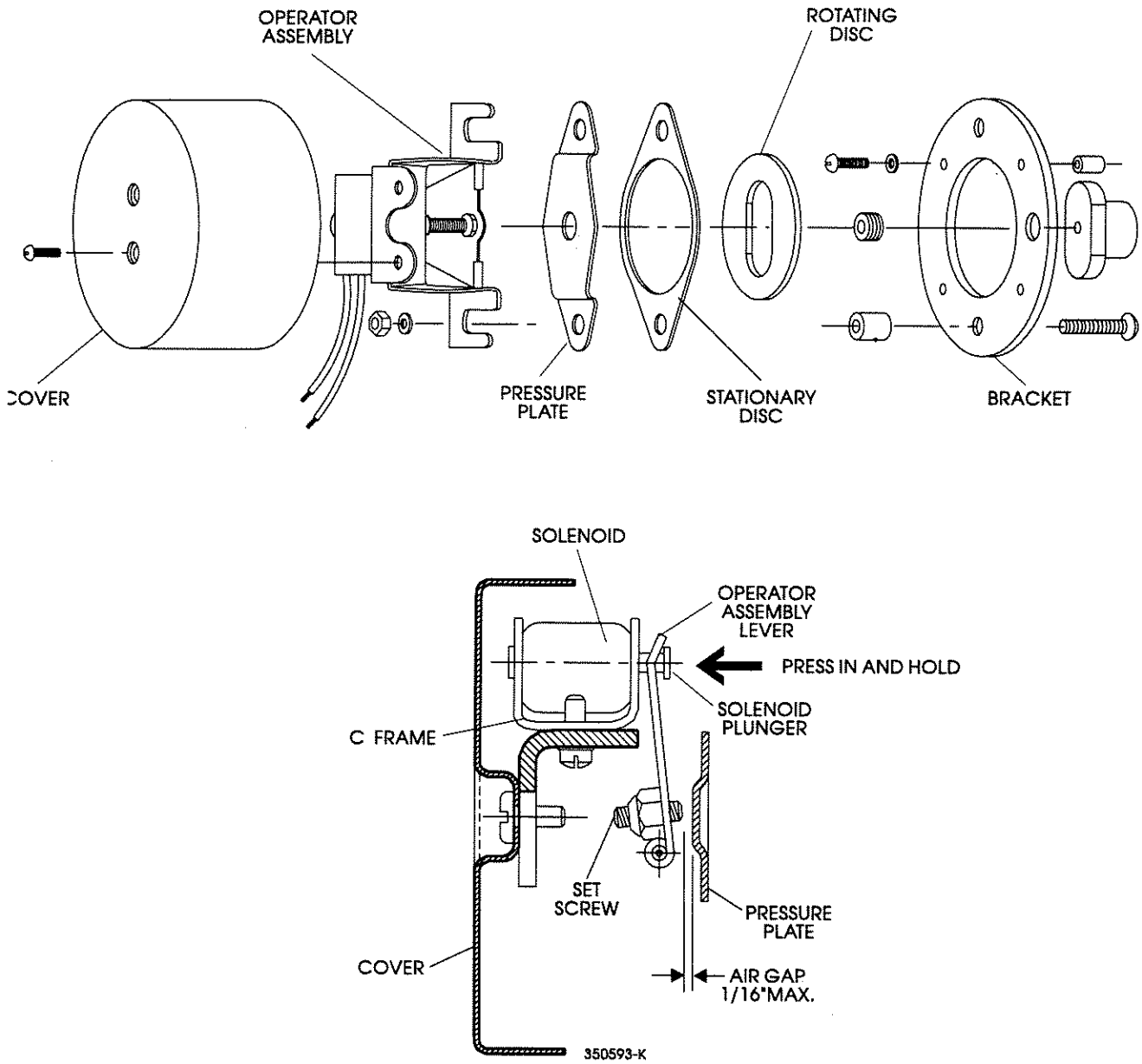


FIGURE 5–14. BRAKE WEAR ADJUSTMENT

BRAKE

DESCRIPTION

The brake engages and holds the load when it is in the POWER OFF condition. It automatically releases when power is applied.

Always disconnect power before working on or near the brake motor or its connected load. If the power disconnect point is out of sight, lock it in the open position and tag to prevent unexpected application of power.

When working on the brake, be sure the lid is completely secured or blocked so as not to cause injury to surrounding personnel or damage to property.

The exterior of the motor or brake may be hot enough to burn.

MAINTENANCE

As the rotating disc wears, the air gap at increases, increasing the stopping time of the brake. Before the air gap exceeds 1/16" maximum (measured on the centerline of the set screw), adjust the air gap.

When total wear on the rotating disc reaches 0.04", replace the rotating disc (see Chapter 6, "Brake").

Delay in adjusting the air gap will result in a loss of torque and/or coil burnout.

Wear Adjustment

1. Remove the cover (see Figure 5–14).
2. Press in and hold the solenoid plunger against the solenoid.
3. Measure the air gap between the set screw and the pressure plate.
4. Turn the set screw clockwise until the set screw air gap is approximately 1/16" maximum.

Observe motor starting characteristics. The motor should start quickly. If not, increase the air gap by turning the set screw 1/8 turn counterclockwise.

LEVEL PROBES LLC1, LLC2

When solution contacts a level probe it closes the switch. This energizes its relay on the Level Control board mounted in the control box. Delays are built in to the Level Control board.

- When solution reaches the low level sensor, it energizes its relay until solution drains below that level. Once the solution has done this, the low level control delays before deenergizing its relay.
  Delay: 3 seconds.
- When solution reaches the high level sensor, it delays before energizing its relay.
  Delay: 2 seconds.

NOTES

- *The delays are the same for each probe. When liquid grounds the probe, the delay is 2 seconds. When the probe is dry, the delay is 3 seconds.*
- *The Level Control Board must have a model number ending in -02, e.g., DFC010-02. Only these model numbers provide the proper delays. If your unit lacks this model number, replace the level control board.*

TEST THE LEVEL PROBES

To simulate the solution level reaching a probe, hold a wet cloth against it, or hold a flat piece of metal (a quarter, for instance) against both the probe tip and the side of the tank. When a probe relay is energized, its LED on the Level Control board lights (see Figure 5–15).

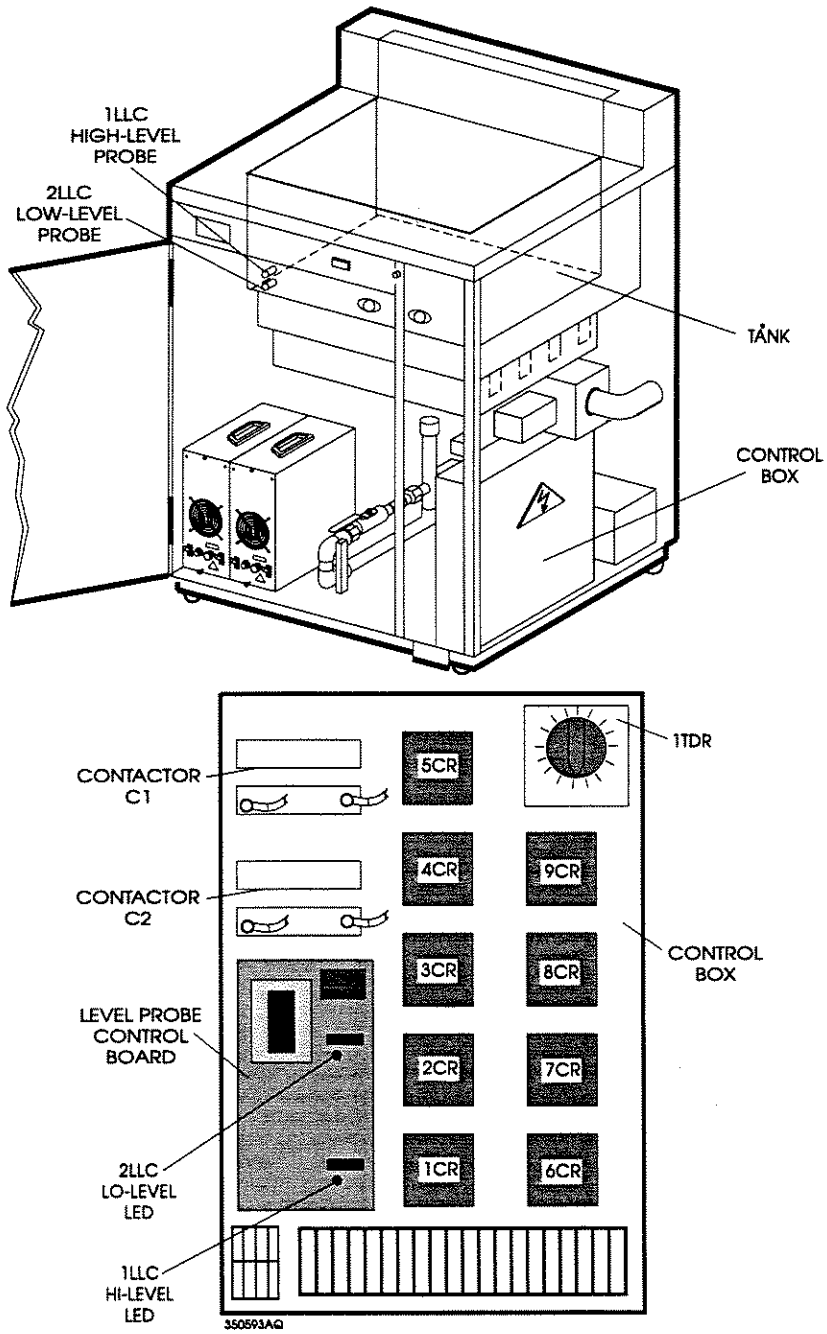


FIGURE 5–15. CONTROL BOX, LEVEL PROBES AND LEVEL PROBE CONTROL BOARD

NOTES

REPAIR

REPLACE THE LID GASKET

The lid gasket is made of four adhesive strips. Replace them when necessary as follows.

1. Remove the existing gasket strips. Tear off as much as possible. Then use lacquer thinner or equivalent to remove old adhesive.
2. Cut new strips. Clean the surface of the lid. Apply the strips to the lid surface.
3. Glue the seams at the corners of the strips to create a good seal. Use *Loc-Tite 380 "Black Max"* or equivalent.
4. For drying time, follow the glue manufacturer's instructions.

MANUALLY OPENING A CLOSED LID

If a closed lid fails to open when LID is pressed (or fails to automatically open), use the following procedure to open the lid manually.

CAUTION

Do not attempt to pry up a closed lid that will not raise automatically. Prying tools could damage the lid gasket or stainless steel surfaces.

1. Turn off power to the unit and remove the half-panel from the rear of the unit (see Figure 6-1).

NOTE

Some installations may not permit access to the back of the unit. In such cases, service personnel will have to reach the "fitting assembly" in Step 2 through the front of the cabinet. Pushing this assembly as in Step 3 will crack the lid open enough so it can be grasped and raised by hand.

2. Grasp the linkage that secures the base of the drive arm to the cam plate. Use both hands.

CAUTION

Pull the linkage only in the direction shown (CW). Pulling the linkage toward the FRONT of the unit (CCW) will break the microswitches.

3. Pull the linkage toward the rear of unit and down.
   - The lid will raise a few inches.
4. Go to the front of the unit and lift the lid to its fully open position.
5. Reassemble the half-panel to the back of the unit.

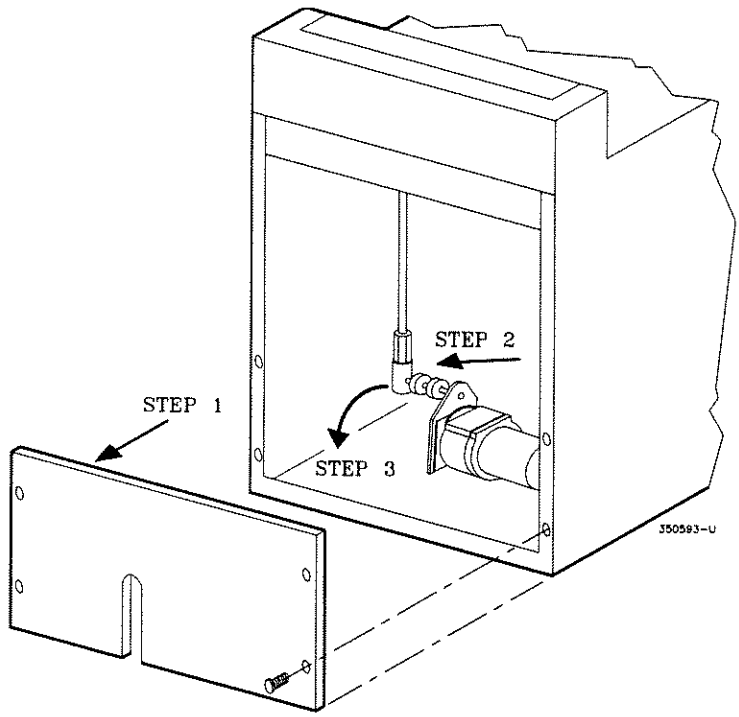


FIGURE 6–1. MANUALLY OPENING A CLOSED LID

REMOVING THE CONTROL PANEL COVER

CAUTION

When the control panel cover is removed, the sliding door is exposed and can drop out. Be careful not to drop the sliding door (see Figure 6-2).

1. Remove the screws that secure the control panel cover.
2. Secure the sliding door so that it does not fall out.
3. Remove the control panel cover from the unit.

   The toe switch plate flips up against the unit.

NOTE

The toe switch plate is on a hinged spring. Whe the control panel is removed, the spring flips up the toe switch plate.

4. When replacing the control panel cover, be sure to position the toe switch plate.
   - During replacement, push down and hold the toe switch plate so that it covers the microswitch and projects below the edge of the control panel cover.
   - Be sure the toe switch plate remains in this position while attaching the control panel cover.

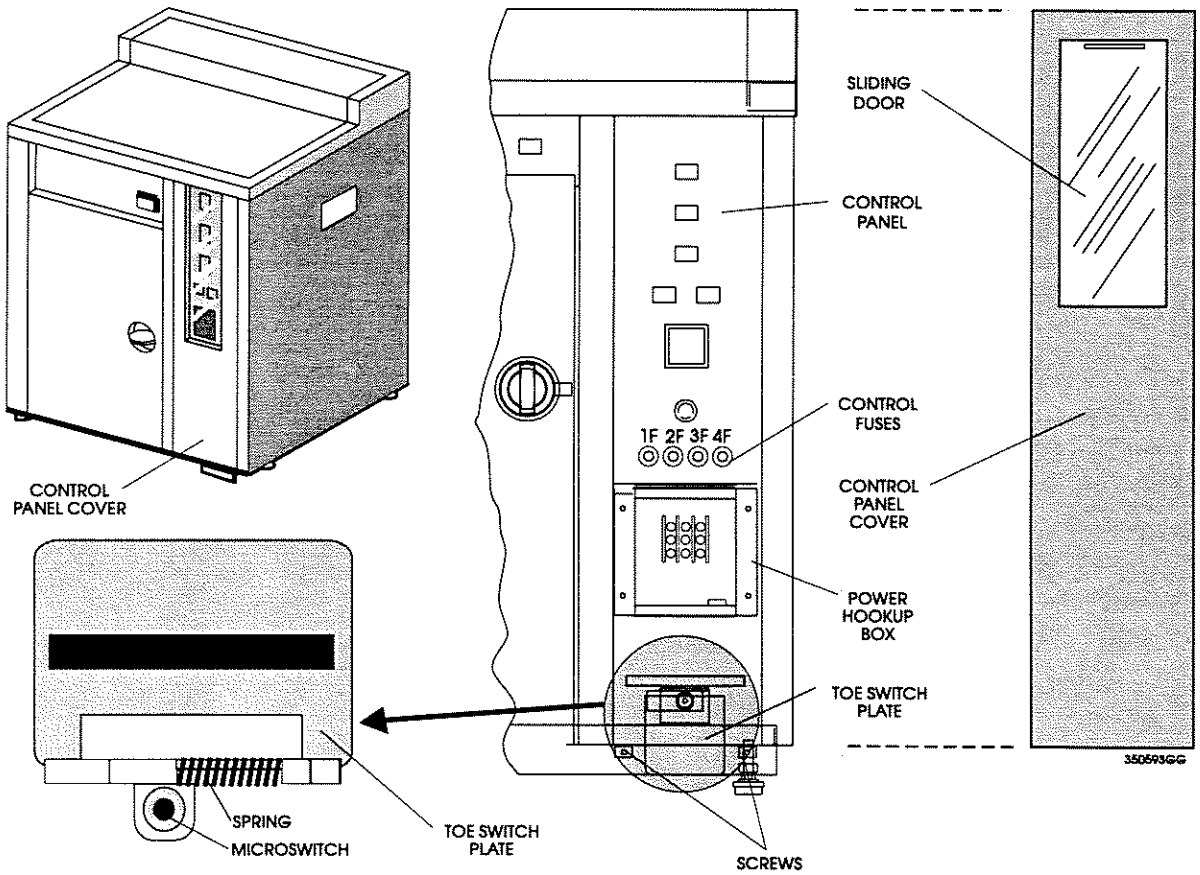


FIGURE 6–2. REMOVE CONTROL PANEL COVER

FUSES

There are control fuses behind the control panel cover. There are also fuses in the sonic generators. Check all fuses during troubleshooting to avoid performing unnecessary repairs.

CONTROL FUSES

NOTE

When the control panel cover is removed, the sliding door is exposed and can drop out. Be careful not to drop the sliding door.

1. Using a screwdriver, remove the control panel cover.

   (See Figure 6-2.)

2. Replace any blown fuses.

NOTE

Fuse 4F is a 15A fuse. Previous ratings of 12A are not adequate for the load. If fuse 4F is rated 12A, replace it with a 15A fuse.

GENERATOR FUSES

External Fuses

Each sonic generator has two external fuses, one in front and one in back.

1. Remove the fuses from their holders and inspect them.
2. Replace any blown fuses.

Internal Fuses

CAUTION

DO NOT OPERATE a sonic generator if the rear cable is disconnected. This will blow the internal fuses and the generator will cease to operate.

1. Remove one generator chassis from its housing. To do this, disconnect the cable at the rear of the generator (See Figure 6-4). Then release the screw at the top of the front panel, and the thumbscrew at the bottom of the front panel (1/4 turn CCW). Slide the chassis forward, out from the housing.
2. Locate and inspect the fuses (see Figure 6-3).
3. Replace any blown fuse with a 250V 0.5 amp fuse. (For part number, see "Recommended Spare Parts," p. 6–13.)
4. Reassemble the generator.
5. Repeat steps 1-4 with the other generator.

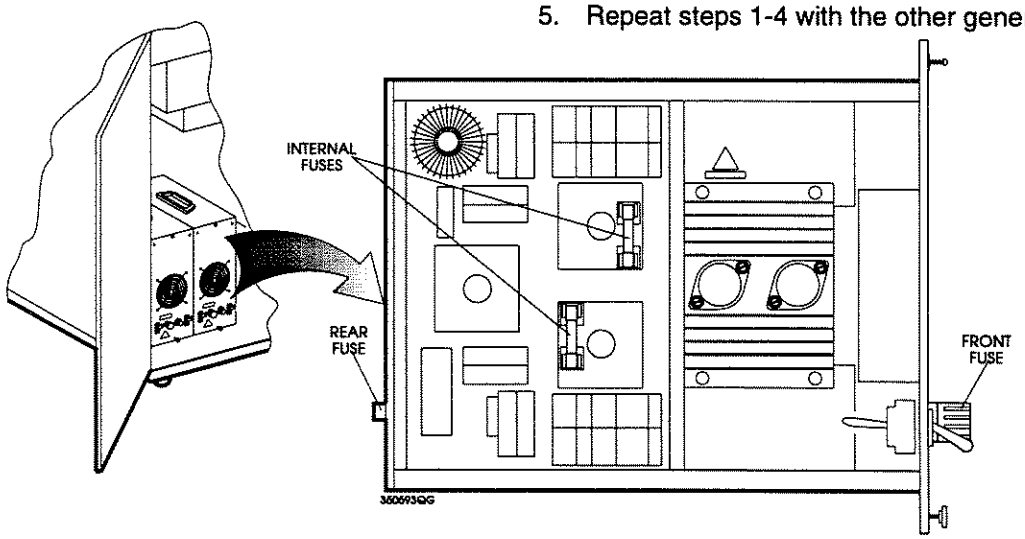


FIGURE 6–3. GENERATOR FUSES

GENERATORS

CAUTION

DO NOT OPERATE a sonic generator if the rear cable is disconnected. This will blow the internal fuses and the generator will cease to operate.

REMOVE THE CHASSIS

1. Disconnect the cable from the rear of the generator (see Figure 6-4).
2. Loosen the top screw and bottom thumbscrew on the front panel of the generator.
3. Slide the generator chassis out the front.

SOLENOID VALVES

Refer to the chart below to be sure the correct parts are used.

REPAIR PARTS FOR SOLENOIDS

VALVE	VALVE NO.	REPAIR PARTS PKG NO.
FILL SOLENOID 1SOL	M3001036	54198
DETERGENT FILL SOLENOID 2SOL	M3001039	54185

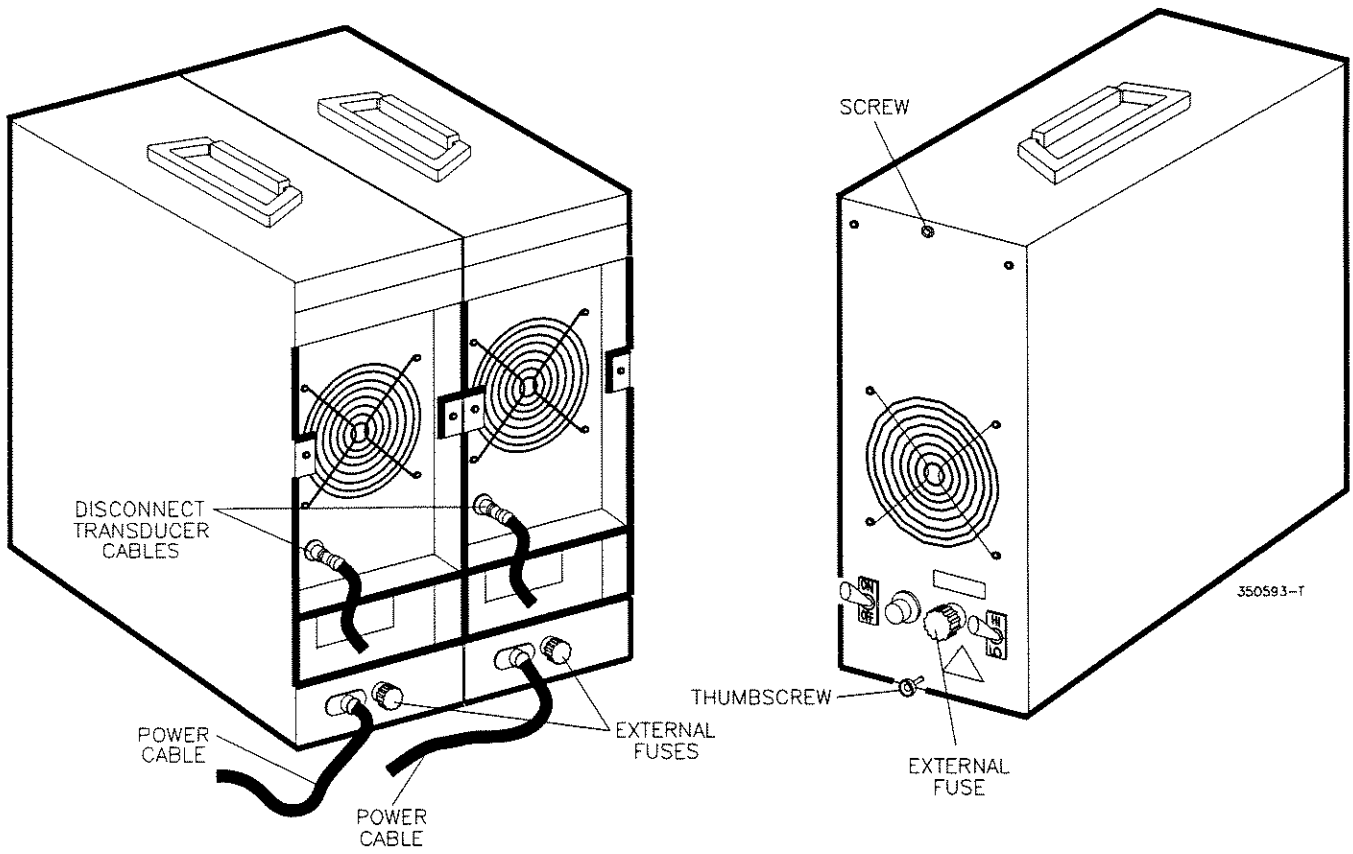


FIGURE 6–4. REMOVING A GENERATOR CHASSIS

REPLACE THE INJECTOR

CAUTION

Do not press down on the detergent flow valve when loosening or tightening the joint to the injector. Undue pressure can break the joint.

NOTE

Use teflon tape on the ejector threads.

1. Remove the faulty injector.
2. Before connecting the detergent flow valve to the new injector, cut and discard the hose barb from the injector port (see Figure 6-5).
3. Chamber (bevel) the inside diameter edge of the opening in the injector port. This will widen the opening slightly and prevent blockages between the flow valve and the injector.
4. Use no wrenches when installing the injector. Teflon tape and hand tightening are all that is necessary.

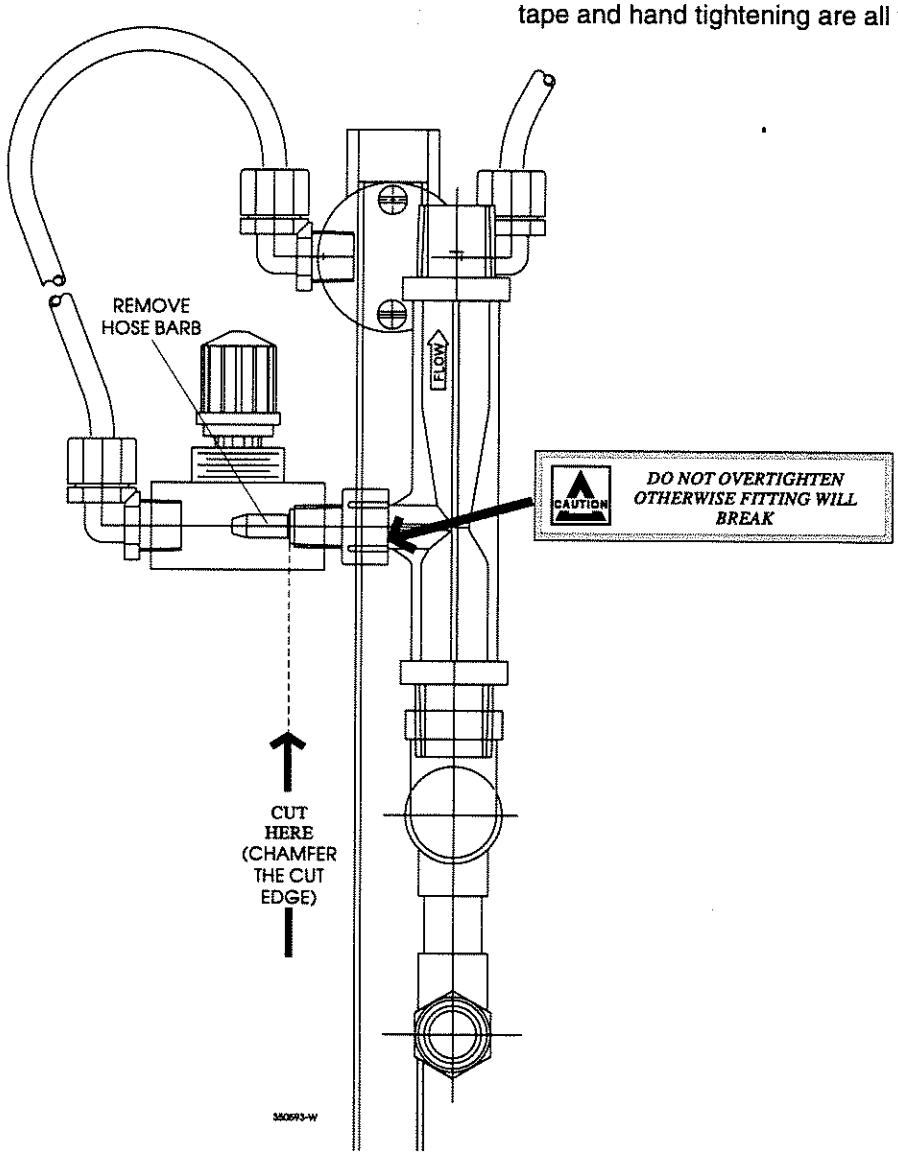


FIGURE 6–5. REPLACE THE INJECTOR

BRAKE

The brake engages and holds the load when it is in the POWER OFF condition. It automatically releases when power is applied.

WARNING

Always disconnect power before working on or near the brake motor or its connected load. If the power disconnect point is out of sight, lock it in the open position and tag to prevent unexpected application of power.

When working on the brake, be sure the lid is completely secured, or blocked so as not to cause injury to surrounding personnel or damage to property.

WARNING

The exterior of the motor or brake may be hot enough to burn.

OPERATION

The brake is a spring set device with an electrical release (solenoid), containing one rotating disc, driven by a hub which is mounted on the motor shaft. When energized, the solenoid release mechanism compresses a spring removing the force on the pressure plate, and permits free rotation of the shaft.

FRICTION DISC REPLACEMENT

CAUTION

Block or secure the lid. The brake will be inoperative during this procedure.

When total wear on the rotating disc reaches 0.04", replace the disc as follows.

1. Disconnect the solenoid from the circuit and remove the brake cover (see Figure 6-6).
2. Remove locknuts, washers, operator assembly, pressure plate, stationary disc, and rotating disc.
3. Replace worn rotating disc and assemble in reverse order.

NOTE

The rotating disc must slide freely over the hub. If not, carve out the hole of the rotating disc until it moves freely.

4. Before installing the operator assembly, turn the adjusting screw counterclockwise 4 or 5 turns. This will allow the operator assembly to be installed without interference.
5. Readjust the Air Gap (see Chapter 5, "*Wear Adjustment*").

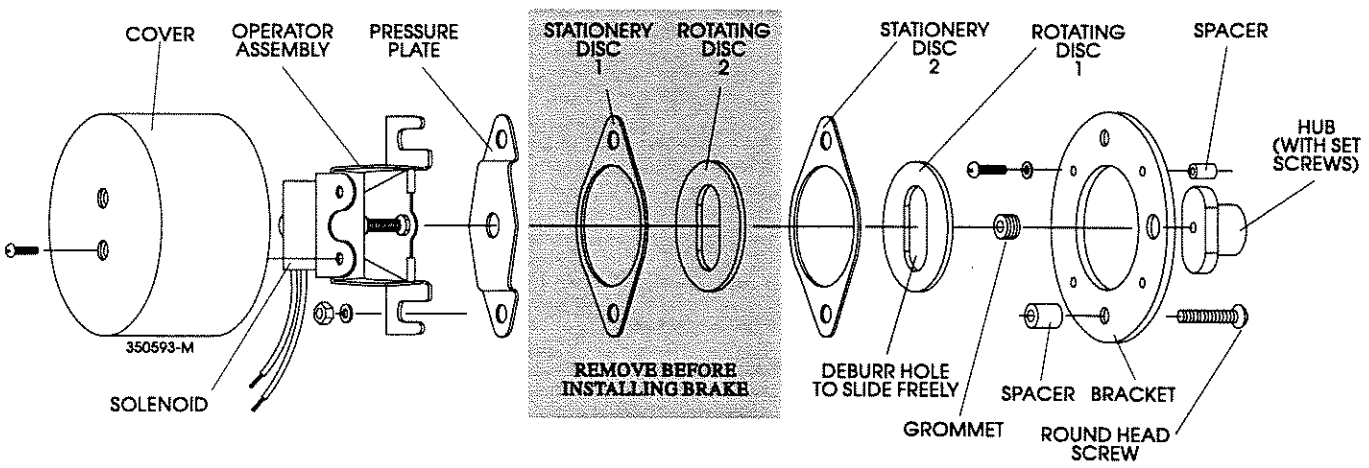


FIGURE 6–6. BRAKE COMPONENTS

SOLENOID REPLACEMENT

CAUTION

Block or secure the lid. The brake will be inoperative during this procedure.

1. Disconnect the solenoid from the circuit and remove the brake cover (see Figure 6-7).
2. Remove the solenoid assembly and the torque spring. To do this, remove the fillister head screws and the split lockwashers.
3. Insert the new solenoid assembly. To do this, slide the plunger into the slot of the operator assembly lever, keeping the torque spring around the plunger.
4. Fasten the solenoid assembly to the mounting bracket, using fillister head screws and split lockwashers.
5. Adjust the air gap (see Chapter 5, "Wear Adjustment").

BRAKE REPLACEMENT

The brake includes two rotating discs and two stationary discs when it comes from the manufacturer. One rotating disc and one stationary disc must be removed to provide the proper torque for use in this unit (see Figure 6–6).

NOTE

The outer stationary disc is 0.030 in. thick, and must be removed.

The inner stationary disc is 0.060 in. thick, and must be located as shown.

TORQUE SELECTION

1. Disassemble the new brake.
2. Depress and hold the solenoid plunger.
3. Remove the outer stationary disc and the rotating disc closer to the solenoid.
4. Set the air gap to 1/16". To do this, turn the set screw clockwise.
5. Release the solenoid plunger.
6. Depress the solenoid plunger several times and recheck the air gap.

BRAKE INSTALLATION

Follow the installation instructions included with the replacement brake.

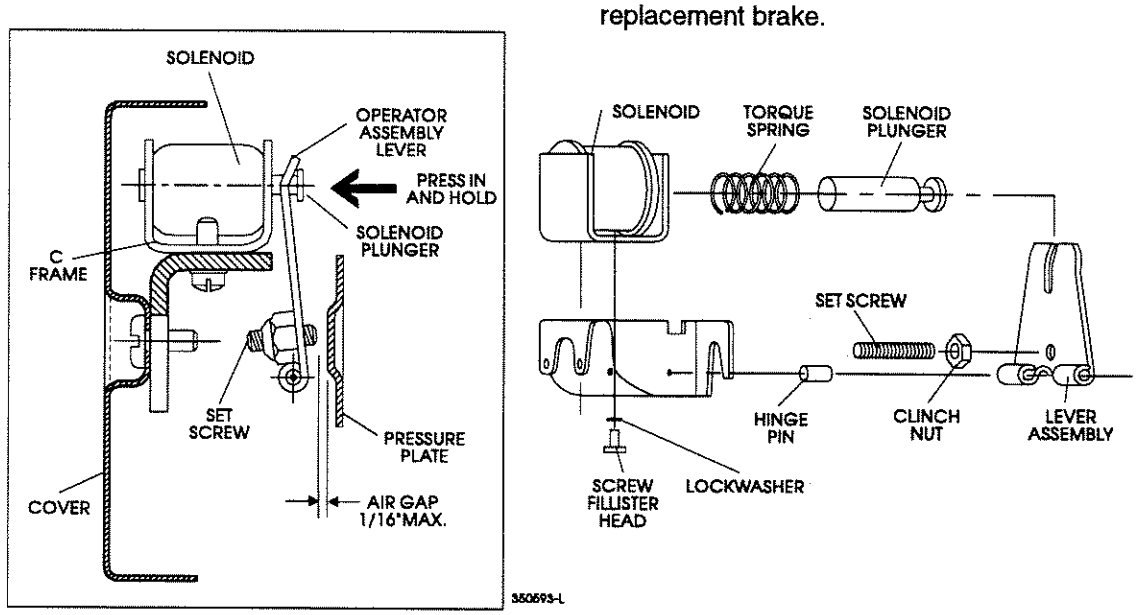


FIGURE 6–7. BRAKE OPERATOR ASSSEMBLY

TORQUE LIMITER

Friction facings and bushings are normally the only parts that require replacement.

NOTE

Before installing new parts, degrease them. Use alcohol or a lacquer-thinner type degreaser.

1. Disassemble the torque limiter as shown (see Figure 6-8).
2. Replace worn friction facings and bushing.

NOTE

Be sure to reassemble the key in the keyway. Otherwise the torque limiter will not function correctly.

3. Reassemble the torque limiter. DO NOT completely flatten the spring.
4. Run-in and adjust the lid as follows:
   a. Unbend the locking ring tabs from over the adjusting nut.
   b. Press LID. The lid will begin to lower.

CAUTION

Be sure that limiter slipping BEGINS only when the lid is lowering.

   c. ONLY WHEN THE LID IS LOWERING, loosen the torque limiter adjustment nut by ¼-turns, until the limiter slips.
      - If the lid fully closes before slipping occurs, press LID to raise the lid. Press LID again to begin lowering.
   d. When the limiter slips and lid motion stops, manually raise the lid to the up position. The motor will continue to run.

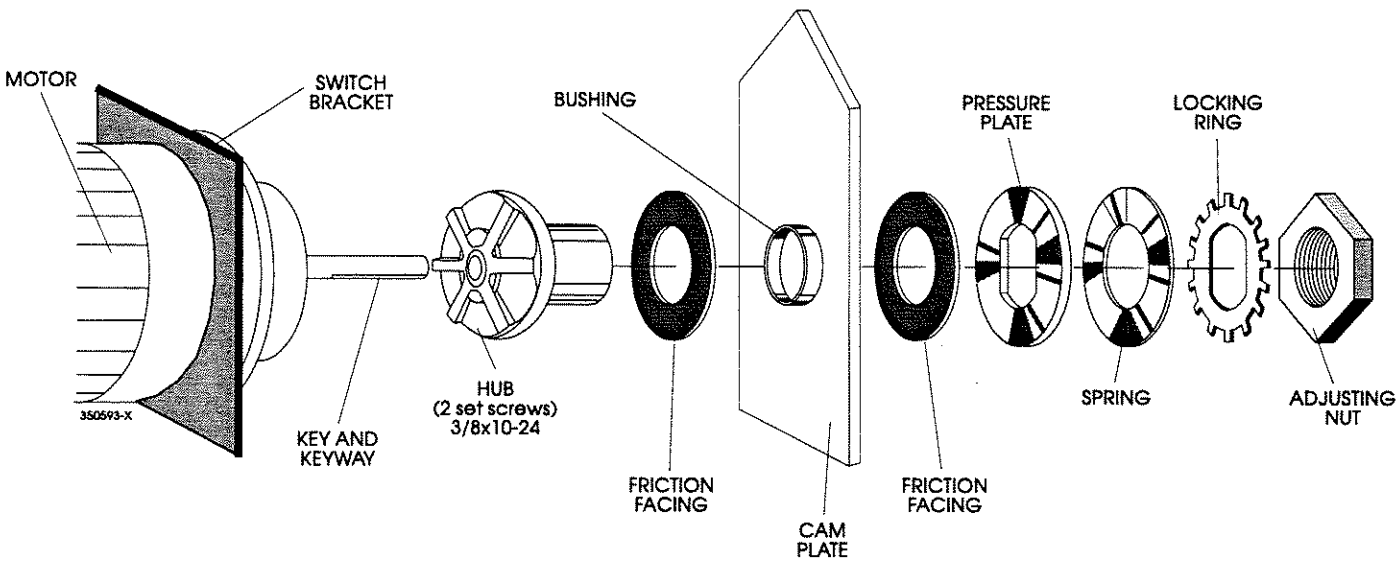


FIGURE 6–8. TORQUE LIMITER

e. When the limiter slips and lid motion ceases, "run in" the torque limiter by letting the motor run for a minimum of four minutes.

f. Center an instrument tray with a 19-pound load on the work platform.

g. Press LID to lower the lid. Tighten the torque limiter adjustment nut by ¼-turns, ONLY WHEN THE LID IS LOWERING, until the limiter stops slipping and the lid continues to lower.

Be sure that limiter slipping ENDS only when the lid is lowering.

h. Press LID to raise the lid. After the lid has raised, remove the instrument tray and load.

i. Press LID to lower the lid. Watch for even operation as the lid lowers.

j. IF THE LID STICKS OR SLIPS WITH NO LOAD:

ONLY WHEN THE LID IS LOWERING, tighten the torque limiter adjusting nut by 1/16-turns until lid travel is smooth.

k. Bend the locking ring tabs over the adjusting nut.

THERMAL SWITCHES 1TAS, 2TAS

REPLACE THERMAL SWITCH

1. Remove the old thermal switch.
   a. Turn off power to the unit.
   b. Disconnect the wires.
   c. Remove the nuts that fasten the switch to the tank.
   d. Remove all old heat sink compound from the surface of the tank. Clean the surface before attaching the new thermal switch.

NOTE

White heat sink compound is available at local electronics supply dealers.

2. Apply white heat sink compound to the new thermal switch.

   Be sure to coat the entire contacting surface.
3. Attach the new thermal switch to the tank.
4. Reconnect the wires.

LIMIT SWITCHES

CAUTION

When replacing a limit switch, handle it by the body only. DO NOT BEND the actuating arm. This could break the switch.

To replace a limit switch:

1. Disconnect the limit switch wires.
2. Loosen the screws holding the limit switch to the switch bracket.
3. Remove the limit switch.
4. Install the new limit switch.
5. Adjust the limit switch (see Chapter 5, "Adjusting the Limit Switches").

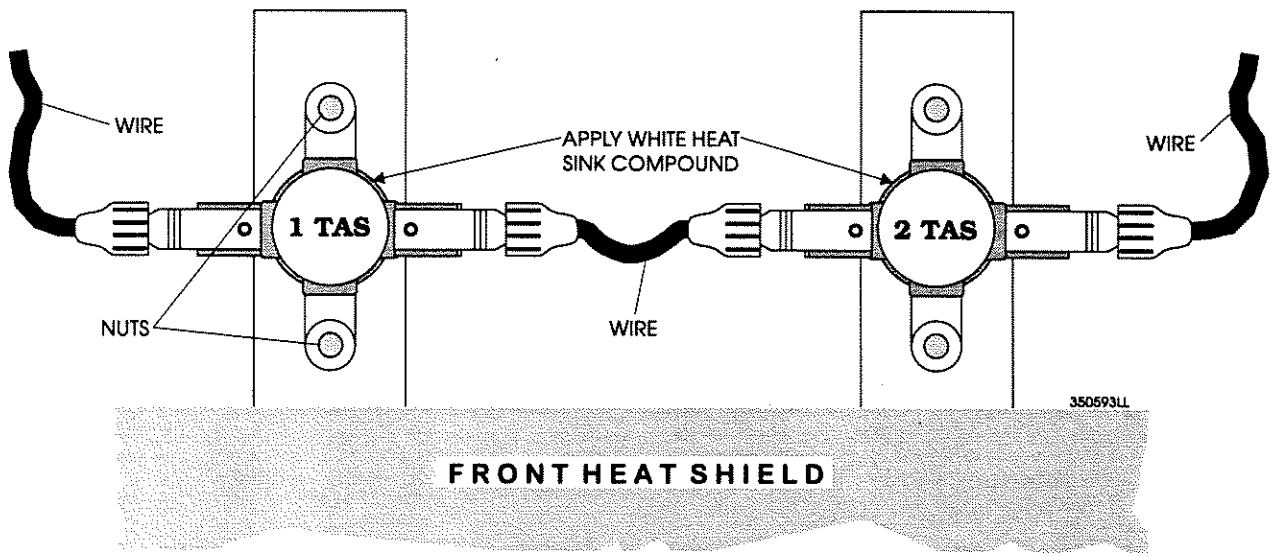


FIGURE 6–9. REPLACE THERMAL SWITCH

HEATER HTR

REPLACE HEATER

1. Remove the old heater.
   a. Remove the heat shields.
      1) Remove the screws securing the front top edges of the LH Heat shield and RH heat shield (see Figure 6–10).
      2) Remove the nuts securing the front heat shield. The front heat shield is now free to remove.
      3) Set the front heat shield aside.
      4) Leave the LH heat shield and RH heat shield attached at the rear.
   b. Disconnect the wires from the heater strip (see Figure 6–11).
   c. Remove the clamps.
   d. Remove the nuts securing the heater strip to the tank.
   e. Remove the heater strip.
   f. Remove all thermal sealant from the surface of the tank. Clean the surface before attaching the new heater.

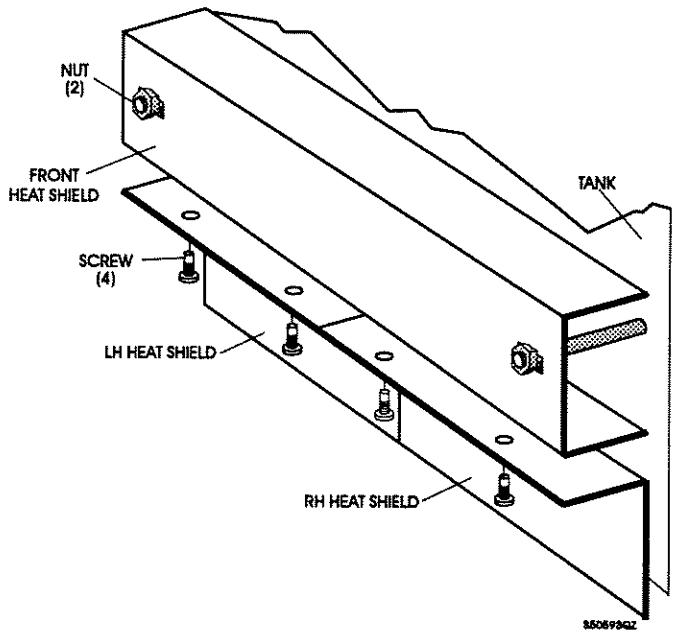


FIGURE 6–10. REMOVE THE HEAT SHIELDS

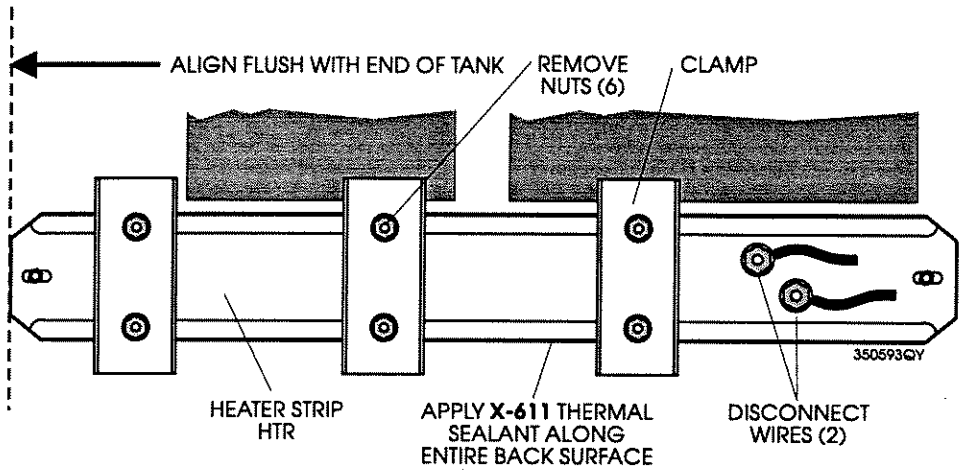


FIGURE 6–11. REMOVE THE HEATER STRIP

2. Attach the new heater.

NOTE

Apply X-611 thermal sealant (P/N 530928) evenly along the new heater strip. This will ensure even heating of the tank and prevent damage from hot spots.

a. Apply X-611 thermal sealant (P/N 530928) along the entire back surface of the new heater strip.

b. Attach the heater strip to the tank surface. Align the left edge of the heater strip with the left edge of the tank.

CAUTION

DO NOT OVERTIGHTEN FASTENERS! Overtightening could break off the mounting studs. This would require replacing the entire tank.

c. Secure the nuts at either end of the heater strip.

d. Fasten the clamps along the heater strip.

e. Connect the wires.

3. Attach the front heat shield to the tank.

4. Attach the LH heat shield and RH heat shield to the front heat shield.

RECOMMENDED SPARE PARTS

QUANTITY	PART NO.	PART NAME
Control Fuses		
3	M2003053	Fuse, 1.75 Amp Fast Blow
3	M2003038	Fuse, 3 Amp Fast Blow
3	M2003045	Fuse, 10 Amp Fast Blow
3	M2003047	Fuse, 15 Amp Fast Blow
Sonic Generator Fuses		
3	54003	Fuse, 8 Amp Fast Blow (Front)
3	534661	Fuse, 250V 0.5 Amp Fast Blow (Internal)
3	M2003045	Fuse, 10 Amp Fast Blow (Rear)
Replacement Parts		
1	M2025008	Brake, Electric
1	M6003002	Torque Limiter
1	M5101005	Motor, 115 VAC, 60 Hz
1	M3023002	Injector, Water
1	M2025007	Alarm, Lid Motion
1	M2020003	Heater, 1000 Watt Strip
1	M2006005	Relay, 3PDT
1	530928	Sealant, X-611 Thermal
2	M9000023	Strainer, Detergent
1	M2002019	Switch, Action (POWER, STOP, DEGAS)
1	M2002002	Switch,Door Interlock
1	M2002001	Switch, Lid Limit (1LS, 2LS)
1	M2002030	Switch, Momentary (FILL, DRAIN, LID)
1	M2002005	Switch, Toe Micro
1	536126	Timer
1	M3001039	Valve, Detergent Supply Solenoid (1/4 FPT)
1	M3001036	Valve, Water Supply Solenoid (1/2 FPT)
1	M3005021	Valve, Flow Control (1/4 FPT)
Specify Length	R3892	Gasket, Rubber Seal

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